SELECTED

SESOURCESRESOURCES ABSTRACTS



VOLUME 2, NUMBER 9 MAY 1, 1969 Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is \$22.00 (domestic), \$27.50 (foreign), single copy price is \$3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.



SELECTED

WATER RESOURCES ABSTRACTS

'A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior



VOLUME 2, NUMBER 9 MAY 1, 1969

WR 69-03201 -- WR 69-03700

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

REFLECTIVITY OF ELECTROMAGNETIC WAVES AT AN AIR-WATER INTERFACE FOR PURE AND SEA WATER,

Hawaii Univ., Honolulu.

Larry K. Lepley, and William M. Adams.

Hawaii Water Resources Research Center, Tech
Rpt No 25, Dec 1968. 15 p, 8 fig, 7 ref. OWRR Project B-008-HI.

Descriptors: *Reflectivity, *Electromagnetic waves, Air-water interface, Sea water, Pure water. *Electromagnetic

The optical properties of electromagnetic waves incident on chemically pure water or sea water have been compiled. This information indicates that behavior is significantly different for the two water types above and below a frequency of 10 billion cy-cles per second. For all lower frequencies, sea water behaves like a metal and pure water behaves water behaves like a metal and pure water behaves like a semi-conductor. For higher frequencies, both fresh and pure water behave as dielectrics having similar optical properties. The optics of natural waters of all salinities are well known only at the visible frequencies. The reflectivity contrast between pure and sea water to visible light, i.e., the bitcher frequencies is approximately 3%. The higher frequencies, is approximately 3%. The reflectivity contrast between sea water and pure water at frequencies less than about 10 billion cycles per second is approximately 44%. W69-03598

02. WATER CYCLE

2A. General

POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
Slovak Technical Univ., Bratislava (C-

zechoslovakia). For primary bibliographic entry see Field 02F. For abstract, see .

W69-03203

THE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,

Manchester Univ. (England); and Salford Univ.

(England). L. Barden, and G. R. Sides

Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 135-138, 1967. 4 p, 2 fig, 2 tab, 9 ref.

Descriptors: *Diffusion, *Air, *Solubility, *Soil water movement, *Porous media, Fluid mechanics, Adsorption, Model studies, Clays. Identifiers: Air diffusion, Multiphase flow, Dif-

fusimeters.

Measurements are reported of the diffusion of air through the pore water of both saturated and compacted clays. It is shown that the average coefficient of diffusion D through adsorbed water is much less than that through free water. As the moisture content of the soil is reduced, the average value of D decreases, suggesting that as the clay surface is approached there is a reduction in D and a consequent increase in the viscosity of the adsorbed water. The marked reduction in D below the level for free water will cause a large increase in the time required for the air-water mixture in a partially saturated soil to reach equilibrium. (Knapp-USGS) W69-03205

REFINEMENT OF PARAMETERS FOR CALCULATING EVAPORATION FROM BOGS ON THE BASIS OF OBSERVATIONS AT BOG STATIONS,

For primary bibliographic entry see Field 02D. For abstract, see.

W69-03211

HYDROLOGIC SUBSTANTIATION AND COM-PUTATION OF THE REDUCTION OF FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS AFTER UNDERFLOODING IN RIVER SYSTEMS, K. Ye Ivanov, and Ye. L. Shumakova.

Transl from Trudy Gos Gidrol Inst, No 145, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 329-347, 1967. 19 p, 11 fig, 5 tab, 15 ref.

Descriptors: *Reservoirs, *Groundwater, *Water level fluctuations, *Saturated soils, *Forests, Water injury, Flooding, River systems.
Identifiers: USSR, Lower Ob' River Basin.

A method is proposed for computing recession of forests in plains affected by rising water tables caused by reservoir inundation of river systems. A theoretical substantiation of the empirical method is given. The computation is designed for cases in which detailed geohydrologic data for the area are not available and stratigraphic cross sections are scarce. An example of the computations is given for the effect of the planned Lower Ob' Hydroelectric plant on the forest cover of the Ob' basin. (K-napp-USGS) W69-03214

SOIL MOISTURE.

National Research Council of Canada, Ottawa (Ontario). Subcommittee on Hydrology. For primary bibliographic entry see Field 02G. For abstract, see . W69-03223

AN APPLICATION OF PRINCIPAL COM-PONENT ANALYSIS AND FACTOR ANALYSIS IN THE STUDY OF WATER YIELD, Tennessee Univ., Knoxville. Dept. of Agricultural

Engineering Engineering. Guillermo Diaz, J. I. Sewell, and C. H. Shelton. Water Resources Res, Vol 4, No 2, pp 299-306, April 1968. 8 p, 7 tab, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Statistical methods, *Watersheds (Basins), Water yield, Runoff, Statistics, Ohio, Texas. Identifiers: Ohio watersheds, Texas watersheds.

Principal component and factor analyses were applied to annual precipitation and runoff data of fourteen watersheds from Coshocton, Ohio, and seven watersheds from Riesel, Texas. The objective was to identify the factors affecting the water yield of these watersheds and to determine the relative importance of the identified factors. From the Ohio watersheds, the rotated factor analysis suggested that watershed area and slope were, in that order, the two most important factors affecting water yield. For the Texas watersheds, three almost equally important watershed factors were identified as the soil type, cultural practices, and land capability. A stepwise regression of runoff-precipitation ratios of the Ohio data on area-slope variables substantiated the effects of area and slope on runoff as determined by the factor analysis. (Steinhilber-USGS) W69-03233

HYDROGEOLOGY OF DESERT BASINS, Nevada Bureau of Mines, Reno. Desert Research

For primary bibliographic entry see Field 02F. For abstract, see . W69-03238

DYNAMICS STREAMS-THEIR MORPHOLOGY, Antioch Coll., Yellow Springs, Ohio. For primary bibliographic entry see Field 02E. For abstract, see. W69-03248

CLIMATE AND SOIL MOISTURE EXTRAC-

Volcani Inst. of Agricultural Research, Bet-Dagan (Israel); and Israel Meteorological Service, Bet-

For primary bibliographic entry see Field 02G. For abstract, see. W69-03250

AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERA-TION OF STREAMFLOW, Washington Univ., Seattle; and Washington Water

Research Center, Pullman.

Archie A. Harms, and Thomas H. Campbell. Water Resources Res, Vol 3, No 3, pp 653-661, 1967. 9 p, 12 fig, 5 ref.

Descriptors: *Streamflow forecasting, *Synthetic hydrology, *Statistical methods, *River systems, Model studies, Computer models, Digital compu-

Identifiers: *Algorithmic methods, Pacific Northwest rivers.

An extension to an algorithm for the sequential generation of nonhistoric streamflow, previously used by Thomas and Fiering, is suggested. The distinguishing features of this model are preserva-tion of (1) normal distribution of annual flows; (2) log-normal distribution of monthly flows; (3) correlation between annual flows; and (4) correlation between monthly flows. This model has been applied to two representative Pacific Northwest rivers. A graphical examination of the results suggests that this model provides an authentic representation of streamflow. W69-03307

THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF CYCLE,

California Univ., Davis. J. Amorocho.

Water Resources Res, Vol 3, No 3, pp 861-880, 1967. 20 p, 12 fig, 32 ref.

Descriptors: *Forecasting, *Rainfall-runoff relationships, *Synthetic hydrology, *Sequential generation, Mathematical models, Simulation anal-

Identifiers: *Hydrologic systems, N systems, Nonlinear synthesis, Uncertainty. Nonlinear

The general theory of nonlinear synthesis and analysis in hydrology is discussed, with particular reference to the problems of predictive uncertainty. These problems are associated with incomplete ty. These problems are associated with incomplete descriptions of the hydrologic systems, limited model-prototype equivalences, system variability in time, and system nonlinearity. Solutions to the nonlinear analysis problem of hydrologic systems under the assumption of approximate time invariance, based on complex cascade network approximations, power series and polynomial expansions, and variable response function approximations are presented. The relations between present theoretical knowledge and its practical application are W69-03308

A REVIEW OF RAINFALL-RUNOFF, PHYSI-CAL MODELS AS DEVELOPED BY DIMEN-SIONAL ANALYSIS AND OTHER METHODS, Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center. D. L. Chery, Jr.

Water Resources Res, Vol 3, No 3, pp 881-889, 1967. 9 p, 1 fig, 12 ref.

Descriptors: *Model studies, *Hydraulic models, *Rainfall-runoff relationships *Hydraulic similitude, *Dimensional analysis, Demonstration watersheds, Analytical techniques, Design. Identifiers: Hydrologic systems, Drainage basin characteristics, Simulation.

Group 2A—General

Model studies of the rainfall-runoff relationship are reviewed. Limited similitude relations for the conreviewed. Limited similitude relations for the construction of physical models of the watershed hydrologic system have been developed, using dimensional analysis, by Mamisao and Chery. Tests on both constructed models indicate that the hoped for similarity did not materialize, and that further testing is necessary to develop empirically the needed similarity relations. Grace and Eagleson have, using differential equations, also developed similitude relations for hydrologic system modeling and discussed the limitations of such modeling. Other individuals are also contemplating modeling, but their endeavors are not concerned with similitude relations, because their devices are non-scaled representatives of parts of the natural hydrologic system. W69-03309

INTERCEPTION BY EASTERN WHITE PINE,

Coweeta Hydrologic Lab., Asheville, N. C. For primary bibliographic entry see Field 02I. For abstract, see . W69-03315

THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS, Southern Forest Experiment Station, Harrison,

For primary bibliographic entry see Field 021. For abstract, see . W69-03339

DISPOSITION OF CONSTANT INTENSITY RAINFALL IN A KARST AREA,

Montpellier Univ. (France). Geologic Lab.

Claude Drogue. Extrait des Annales de Speleologie, Tome 19, F 4, pp 631-634, 1964. 4 p, 1 fig, 4 ref.

Descriptors: *Precipitation (Atmospheric), *Rainfall disposition, *Rainfall-runoff relationship, Rainfall intensity, Infiltration, Evaporation, Karst, Evapotranspiration, Meteoric water, Groundwater. Identifiers: France, Karst topography.

Disposition of constant intensity rainfall was investigated on the basis of Linsley's investigation (Trans. A.S.C.E., V. 68, 1942) and the studies of karst areas conducted by the author in Langedoc. By using the generalized formula of hydrologic balance, i.e. P (precipitation atmospheric)— E (evaporation)+ R (runoff)+ I (infiltration), two diagrams giving the disposition of rainfall in the karst areas for dry and wet seasons were presented. The diagrams show that, to some extent, the calcareous basins may be identified by the degree of their karstification. (Gabriel-USGS)

HYDROLOGY OF SURFACE MINING-A CASE

STUDY, Indiana Univ., Bloomington. Yaron M. Sternberg, and Allen F. Agnew. Water Resources Rep, Vol 4, No 2, pp 363-368, Apr 1968. 6 p, 3 fig, 9 ref.

Descriptors: *Strip mines, *Strip mine lakes, *Hydrology, *Mathematical models, Infiltration, Water table, Water level fluctuations, Discharge (Water), Groundwater movement, Streamflow. Identifiers: Surface mining, Surface mining hydrology.

A mathematical model representing a strip-mined area is formulated and analyzed. Solutions are obtained for the changes in groundwater elevation and groundwater flow that would occur in response to a uniform rate of deep percolation over the spoil bank. The solutions developed are for a bounded 1-dimensional aquifer (spoil bank) where the water level in the last cut (ditch) is a function of time described by an error function. Computed curves showing the groundwater elevation for 2 particular

sets of aquifer characteristics for various times are presented. The solution for the groundwater flow can be used to forecast maximum and minimum flows from the spoil bank to the last cut. The for-mulation of the model is based on some preliminary data and may require some modification as more data become available.

W69-03547

THE USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW SYNTHESIS,

Geological Survey, Washington, D. C. Ernest D. Cobb.

Geol Surv Res 1968, Prof Pap 600-D, pp D48-D51, 1968. 4 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, Hydrographs, Streamflow forecasting, Alabama, Precipitation (Atmospheric). Identifiers: *Peak streamflow synthesis, Recur-

rence intervals, Flood frequencies, Flood peaks.

A major problem in the extension of peak streamflow records by synthesis from precipitation records is to obtain a representative long-term precipitation record for the particular basin being studied. To help solve this problem a flood-frequency curve at a given site was developed using long-term precipitation records from surrounding areas and a relation with 3 climatic variables. This method was used on 2 Alabama streams and may be applicable to other similar areas. For a selected streamflow site, a set of frequency curves is synthesized from long-term precipitation records of surrounding areas. The flood of a given recurrence interval, T, for the stream site studied is then estimated from a relation between the T-year floods, A major problem in the extension of peak streammated from a relation between the T-year floods, obtained from the set of synthesized frequency curves, and a rainfall variable. (USGS) W69-03562

2B. Precipitation

METEOROLOGICAL STUDIES IN THE MAR-MOT CREEK WATERSHED, ALBERTA, CANADA, IN AUGUST 1965, Canadian Meteorological Service, Toronto (On-tario); and East Slopes Watershed Research Pro-gram, Calgary (Alberta). For primary bibliographic entry see Field 02D. For abstract, see . W60-03330

W69-03330

RELATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN WESTERN OREGON AND WASHINGTON, Weather Bureau, Portland, Oreg. River Forecast

Center.
Vail P. Schermerhorn.
Water Resources Res, Vol 3, No 3, pp 707-711, 1967. 5 p, 4 fig, 1 tab, 12 ref.

Descriptors: *Precipitation (Atmospheric), *Rainfall disposition, *Topography, *Distribution patterns, *Mountains, Washington, Oregon. Identifiers: Topography-precipitation relationships, Cascade Range, Barrier elevation, Index elevation, Index latitude.

Average annual precipitation in western Oregon and Washington varies from less than 20 in. to over 150 in. in obvious general relation to the topographic influences of the Coast and Cascade mountain ranges. If these influences could be isolated and measured, it would result in better definition of the precipitation resource in the mountainous areas of saarse measurements. Testing of the perspectation the precipitation resource in the mountainous areas of sparse measurements. Testing of the parameters and methods used by investigators in other regions led to the development of simple indexes to terrain elevation and barrier elevation. Together with a latitude index, they explain most of the variation in precipitation among the more than 280 stations. The key to the method is in the empirical definition of the contours of 'effective' barrier elevation. The pattern of residual errors from the graphical correlation shows no need for the usual zone parameter. W69-03340

FREQUENCY OF WET AND DRY SPELLS AT FIVE STATIONS IN RAJASTHAN, Colaba Observatory, Bombay (India).

B. R. D. Gupta. Indian Journal of Meor and Geophysics, Vol 17, No 3, pp 451-456, 1966. 6 p, 1 fig, 8 tab.

Descriptors: *Dry seasons, *Wet seasons, Arid lands, *Monsoons, Precipitation (Atmospheric), *Rainfall disposition, Data collections, *Frequency, Meteorological data. Identifiers: *Rajasthan (India).

The main source of rain in arid Rajasthan, India is the main source of rain in and kajasthan, india is the southwest monsoon period from June to September. Frequencies of wet and dry spells at five stations in Rajasthan for the southwest monsoon period were studied. The study was based on daily rainfall data of these stations from 1891 to 1919. Tables were included which gave a general average picture of the rainfall of the area during the period of study. Frequencies of rain spells greater than 10. of study. Frequencies of rain spells greater than 10 days were rare and those less than 5 days were common. Frequencies of dry spells less than 5 days were common for all 5 stations. Frequencies of dry spells greater than 15 days were also common at 3 of the 5 stations. (Affleck-Ariz) W69-03490

A FIRST-ORDER MARKOV MODEL FOR AS-SESSING RAINFALL DISCONTINUITY IN CEN-TRAL AUSTRALIA,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia); and Central Arid Zone Research Inst., Jodhpur (India). E. A. Fitzpatrick, and A. Krishnan. Archiv fur Meteorologie, Geophysik and Bioklimatologie, Serie B, Vol 15, No 3, pp 242-259, 1967. 18 p, 2 fig, 7 tab, disc.

Descriptors: *Rainfall, *Rainfall disposition, *Statistical methods, *Markov processes, Mathematical studies, Frequency, Equations, Dry seasons, *Data collections, Arid climates, Probability, Model studies, Wet seasons. Identifiers: First-Order Markov Model, Australia.

The applicability of a simple first-order Markov model within the arid interior of Australia was examined using rainfalls combined over five-day periods. The periods were classed as either wet or dry according to whether a total of at least 0.1 inch of rain had occurred. A Markov model and a simple transfer metall was recorded for distributions. of rain had occurred. A Markov model and a simple random model were constructed for distribution of runs of wet and dry periods. The random model gave a poor fit to the observed frequencies. The Markov model could be further improved to be a practical statistical tool for assessing the long-term incidence of runs of wet or dry weather in arid central Australia. (Blecker-Ariz) W69-03494

THE SPATIAL DISTRIBUTION OF STORM

THE SPATIAL DISTRIBUTION OF STORM RAINFALL,
Water Resource Board, Reading (England).
Research Div.; and Newcastle-upon-Tyne Univ.,
(England).
V. K. Collinge, and D. G. Jamieson.
J Hydrol, Vol 6, No 1, pp 45-57, Jan 1968. 13 p, 7 fig. 6 ref.

Descriptors: *Spatial distribution, *Rainfall intensity, *Storm runoff, Flood forecasting, Rain gages, Orography, Topography, Identifiers: *Surface-wind direction, Tyne River,

The various parameters affecting the distribution of rainfall over an area were investigated. It is probable that detailed distribution is determined within the atmospheric boundary layer. This investigation confirms that surface-wind direction, in association with topography, causes the observed spatial distribution patterns in rainfall. As the topography is fixed, then the variation in position of rain-shadow

areas on the leeward side of hill barriers is governed by the surface-wind direction. The areal extent and nature of these rain-shadow areas is extremely variable and dependent to some degree on the instability, largely a function of surface-wind speed, induced in the atmospheric boundary layer by the orographic barrier. Results show that raingage data together with surface-wind information permits a reasonable estimate to be made of the average areal storm rainfall over the subcatchments. Utilizing this method of flood warning system for the river Tyne would involve telemetering a minimal amount of information to a control center, where the resulting estimated rainfall amounts could be used for predicting flood hydrographs at selected points within the drainage system. (Llaverias-USGS) W69-03534

HURRICANE 'BEULAH', SEPT. 8-21, 1967. Corps of Engineers, Galveston, Tex.

Corps of Eng Rep on Hurricane 'Buelah', Sept 8-21, 1967, 26 p, Sept 1968. 76 plate, 21 photo, 5

Descriptors: *Hurricanes, *Texas, Damages, Winds, Flood damage, Tornadoes, Disasters. Identifiers: Hurricane Beulah (1967).

The meteorologic and hydrologic phenomena of hurricane Beulah, September, 1967, are described and the damages to physical property are evaluated. The major disaster area declared by the President included 29 counties in south Texas. About 1.4 million acres of land were inundated by rain and 630,000 acres by storm tides. A total of 115 tornadoes were reported. The total damage was estimated to be \$168,844,000. Rains of 10-30 in. fell on the area. Winds of over 130 mph were recorded just before the storm reached Texas. Tides of over 10 ft higher than normal were recorded. (Knapp-USGS)
W69-03543

2C. Snow, Ice, **AND Frost**

OBSERVATIONS OF SNOW ACCUMULATION AND MELT IN DEMONSTRATION CUTTINGS OF PONDEROSA PINE IN CENTRAL ARIZONA,
Rocky Mountain Forest and Range Experiment

Station, Fort Collins, Colo.; and Northern Arigzona

Univ., flagstaff.
Edward A. Hansen, and Peter F. Ffolliott.
U S Department of Agriculture, Forest Service,
Research Note RM-111, pp 1-12, 1968. 1 fig, 1
photo, 11 chart, 10 ref.

Descriptors: *Water yield improvement, *Snow management, Snowpacks, Snowmelt, Snow cover, Water conservation, Forest management, Clearcutting, Cutting management, Arizona.

A clearcut block on a north aspect and strips with widths of one and one-and-one-half times tree height on a east aspect increased snow accumulation and increased rates of melt and daily water loss. A strip three-fourths as wide as tree height on a west aspect increased snow accumulation. None of the strips cut on south and southwest aspects affected snowpacks measurably.

W69-03408

ATMOSPHERIC HUMIDITY MEASUREMENT

NEAR THE SNOW SURFACE,
Rocky Mountain Forest and Range Experiment

Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo. James D. Bergen. U S Department of Agriculture, Forest Service, Research Note RM-116, pp 1-4, 1968. 1 fig. 5 chart, 5 ref.

Descriptors: *Hygrometry, Snow cover, Water vapor, Vapor pressure, Evaporation, Humidity.

Identifiers: Snow temperature.

Describes a technique for measuring atmospheric humidity in the first few centimeters over a snow cover. Results are presented for four observation periods. The water vapor density at a nominal reference level of 2 cm. above the snow surface was found to vary from less than 20 percent to 90 percent of the density corresponding to saturation at the snow surface temperature. Little diurnal varia-tion was found for the Bowen ratio. Possible remedies for difficulties encountered in the measurements are described. W69-03409

THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,

Cold Regions Research and Engineering Lab., Hanover, N. H.

For primary bibliographic entry see Field 05C. For abstract, see . W69-03546

2D. Evaporation and **Transpiration**

REFINEMENT OF PARAMETERS FOR CALCU-LATING EVAPORATION FROM BOGS ON THE BASIS OF OBSERVATIONS AT BOG STA-

L. G. Bavina

Transl Trudy Gos Gidrol Inst No 145, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 348-370, 1967. 23 p, 9 fig, 25 tab, 15 ref.

Descriptors: *Evaporation, *Bogs, Energy budget, Light, Meteorology, Climates, Albedo, Thermodynamic behavior, Thermal capacity, Heat transfer, Air temperature, Radiation, Humidity. Identifiers: USSR, Radiometers, Evaporimeters.

A method of calculating evaporation from bogs is described and the parameters of the working formula are refined on the basis of observations at bog stations. The characteristics of the radiation balance are analyzed and the balance is computed from observations at actinometric and meteorological stations. New maps of evaporation from highmoor and lowmoor bogs are constructed for the growing season. Evaporimeters are used with energy budget methods to verify the results of empirical methods of evaporation estimation. W69-03211

METEOROLOGICAL STUDIES IN THE MAR-

METEOROLOGICAL STUDIES IN THE MAR-MOT CREEK WATERSHED, ALBERTA, CANADA, IN AUGUST 1965, Canadian Meteorological Service, Toronto (On-tario); and East Slopes Watershed Research Pro-gram, Calgary (Alberta). R. E. Munn, and D. Storr. Water Resources Res, Vol 3, No 3, pp 713-722, 1967. 10 p, 10 fig, 8 ref.

Descriptors: *Evapotranspiration, *Forests, *Mountains, *Micrometeorology, *Water balance, Winds, Air circulation, Radiation, Rain gages, erature.

Identifiers: Canada, Alberta, Rocky Mountains.

The meteorology of a mountainous watershed in the Alberta Rockies was shown to be strongly influenced by upslope-downslope diurnal wind circulations during rainfree periods of observation in August 1965. The evapotranspiration from the forest is inferred from measurements of net radiation above the canopy and from vertical tempera-ture gradients obtained from an 80-ft tower. The forest loss during August rainfree periods is estimated to be between 0.15 and 0.6 gm/sq cm/day with high confidence, or between 0.25 and 0.48 gm/sq cm with somewhat less confidence. A 'best' engineering estimate of evapotranspiration is 0.3 gm/sq cm/day. W69-03330 EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON EVAPOTRANSPIRATION, Southeastern Forest Experiment Station, Franklin,

J. E. Douglass

Reprint from Int. Symp. on Forest Hydrology, Penn State Univ 1965, 451-461, Pergamon Press, Inc. New York, 1967.

Descriptors: *Evapotranspiration, *Plant physiology, *Deciduous forests, *Coniferous forests, Grasses, Root distribution, Water yield improvement, Watershed management, Microclimatology. Identifiers: *Rooting depths, Rooting habits.

This paper reviews research concerned with effects of species and their arrangement on evapotrans-piration. In general it was observed that grasses use less water than forest species because of the shal-lower rooting habits of grass, but if evapotranspira-tion differences occur between forest species, they could not be detected except where rooting depths were unequal. Evapotranspiration varies with stand density and vegetative height, at least in humid regions, and evapotranspiration probably varies with slope and aspect as well.

W69-03386

COMPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE PSYCHROMETER FOR MEASURING LEAF WATER POTEN-TIALS,

Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C. For primary bibliographic entry see Field 021. For abstract, see. W69-03390

MEASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,

Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C. For primary bibliographic entry see Field 021. For abstract, see .

EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,

Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C. For primary bibliographic entry see Field 021. For abstract, see . W69-03393

DESIGN CRITERIA FOR INTERCEPTION STU-DIES.

Southeastern Forest Experiment Station, Franklin,

For primary bibliographic entry see Field 021. For abstract, see . W69-03395

TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED, Southeastern Forest Experiment Station, Franklin,

N. C., and Connecticut Agricultural Experiment Station, New Haven. P. E. Waggoner, and J. D. Hewlett. Water Resources Research 1 (3):391-396, 1965.

Descriptors: *Demonstration watersheds, *Transpiration, *Stomata, *Streamflow, Retardants, Inhibitors, Films, Chemcontrol, Watershed manage-

Identifiers: *Experimental watersheds, Suppres-

The glyceral half-ester of decenylsuccinic acid (GlOSA) closes tree stomata when sprayed directly upon the undersides of leaves. At Coweeta Hydrologic Laboratory a 12% reduction in transpiration might be detected as a significant increase in streamflow. Two sprays of 50 lbs. of GIOSA in

Group 2D—Evaporation and Transpiration

water applied to 30 acres of one watershed from a helicopter produced little deposit on the undersides of leaves and no clear evidence of stomatal closure. Observed increases in streamflow were statistically insignificant. W69-03396

DETERMINING EVAPO TRANSPIRATION BY THE GRAVIMETRIC METHOD FOR THE WHEAT CROP IN THE IRRIGATION DISTRICT OF RIO YAQUI, SONORA, MEXICO. International Commission on Irrigation and

International Commission on Irrigation and Drainage, Annual Bulletin, pp 69-71, 1967. 3 p, 3

Descriptors: *Evapotranspiration, *Gravimetric analysis, *Wheat, *Consumptive use, On-site tests, Sampling, Electrical conductance, Wilting point, Field capacity, Rainfall, Density, Irrigation efficiency, Soil moisture, Plant growth, Root systems. Identifiers: Sonora (Mexico), *Blaney-Criddle method method.

The gravimetric method was used to determine evapotranspiration for the wheat crop in the irriga-tion district of Rio Yaqui, Sonora, Mexico. The gravimetric method consists of determining the moisture variations in each layer making up the soil profile, down to a depth (75cm.) equal to that reached by the root-system of the crop studied. From the average consumptions the coefficients of consumptive use were computed according to the modified Blaney-Criddle method. The modifications was necessary in order to attain a better cor-relation between the mean temperature values and the corresponding consumptive uses. Coefficients of consumptive use over the plant growth for four crop years were given. (Blecker-Ariz) W69-03497

ACCURACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN RATIO METHOD.

Agricultural Research Service, Tempe, Ariz. Water Conservation Lab.

Leo J. Fritschen.

Bull International ass Sci Hydrol, Vol 10, No 2, pp 38-48, Jan 1965. 11 p, 6 fig, 2 tab, 2 append.

Descriptors: *Evapotranspiration, *Lysimeters, *Arid climates, Arizona, *Air temperature, *Vapor pressure, Radiation, Evaporation, Flucuation, Solar radiation, Heat, Meteorological data, Measurement, Instrumentation, Diurnal, Wind velocity, Soil temperature. Identifiers: Bowen ratio method.

Evapotranspiration rates calculated meteorological data by the Bowen ratio method were tested against rates obtained from weighing yeine tested against rates obtained from weigning lysimeters to determine whether the instrumentation and method would yield reliable results in a hot arid environment. The tests were conducted near Phoenix, Arizona, where evapotranspiration generally exceeds net radiation. The Bowen ratio is the ratio of sensible heat to latent heat. Air-temperature and vapor-pressure differences obtained as 15 millust exercises at heights of from 5 to 40 cm. perature and vapor-pressure differences obtained as 15 minute averages at heights of from 5 to 40 cm above the crop surface were used to calculate evapotranspiration. The method could be used successfully to determine the evaporative flux for short periods which later could be summed for longer periods. (Blecker-Ariz) W69-03504

2E. Streamflow and Runoff

NUMERICAL MODEL OF THE NONSTATIONARY TEMPERATURE FIELD OF FLOW-ING BODIES OF WATER, Sredneaziatskii Nauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).

Yu. M. Denisov, and L. M. Oreshina

Transl from Izvestiya Akademii Nauk Uzbekskoy SSR, Seriya teknicheskikh nauk, No 6, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 405-409, 1967. 5 p, 6 ref.

Descriptors: *Water temperature, *Reservoirs, Mathematical models, Digital computers, Energy budget, Heat transfer, Radiation. Identifiers: USSR, Reservoir water temperature.

A numerical model of the temperature field of flowing bodies of water is presented. The problem is solved for depth and temperature. It is assumed that heat derived from the inflow and outflow of water is evenly distributed over the volume of the reservoir so that outflow temperature can be taken as the average temperature of the water body. The parameters used are water turbulence, water albedo, incident solar radiation, heat input from precipitation, bottom temperature, air temperature, and atmospheric turbulence. The equations presented can be solved on a digital computer. (K-napp-USGS)
W69-03213

FUNDAMENTALS OF HYDROLOGIC FORECASTING, Josef Matusewicz

Translated from Polish book 'Podstawy Prognoz Zjawisk Hydrologicznych'. Rep of Cent Inst for Sci, Tech and Econ Inform, Warsaw, Poland, 169 p, 1968, 46 fig, 17 tab, 50 ref. Available as TT66-

Descriptors: *Streamflow forecasting, *Runoff forecasting, Hydrogeology, Statistical methods, Rainfall-runoff relationships, Routing, Stage-discharge relations, Hydrographs, Stream gages, Infiltration, Ice, Freezing, Thawing. Identifiers: *Poland, Hydrological forecasting.

The hydrological forecasting methods used in Poland are described in detail in a book concerned primarily with forecasting methodology. The 7 chapters cover fundamentals of forecasts, forecast methods, forecasts of Spring floods, forecasts of Summer and Fall floods (from rainfall), periodic summer and ran 11000s (from rannal), periodic forecasts, forecasts of ice phenomena, and a summary. Data requirements, present data collection methods, and needs for improved data are discussed. Most of the forecasting methods given are empirical in nature and are based largely on are empirical in nature and are based largely on stage-discharge relations for past similar general hydrological and meteorological conditions. Research on forecasting methods using general meteorological and hydrological data aided by theoretical models is being done, particularly for long-range forecasts. Runoff management and urbanization effects are under study. Statistical methods are approached with attention to the physics of the phenomena involved, to elucidate the fundamental laws of the meteorological and hydrological processes in streamflow. (Knapphydrological processes in streamflow. (Knapp-USGS) W69-03218

SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA, Montana Univ., Missoula. Dept. of Geography.

Chester B. Beaty.
Sponsored by US Army Natick Laboratories,
Natick, Mass. DA19-129-AMC-987 (N). Earth Sci
Lab Tech Rep 68-31-ES, Ser ES-37, Jan 1968. 96
p, 55 fig, 1 tab, 21 ref, 1 append. 1T025001A29.

Descriptors: *Floods, *Aliuvial channels, *Storm runoff, *California, *Nevada, Snowmelt, Cloudbursts, Mudflows, Flood damage, Erosion, Alluvium, Washouts, Roads.

Identifiers: *Alluvial fans, White Mountains (Cal-

A field study of flood conditions in the White Mountains of California and Nevada was carried out during the period September 1966 to August 1967. The investigation was a follow-up to a similar

study conducted in 1956-57. The purpose of the current study was to determine what changes, if any, flooding had produced in the area during the decade 1957-66 and to observe flooding in action and record its effects. Flooding during the decade 1957-66 produced significant changes in parts of the White Mountains landscape. One minor and 2 major debris flows occurred, and minor snowmelt flooding was frequent. Flooding observed during the contract period was of Wintertime, Snowmelt, and Cloudburst types. Floods were observed in December 1966, May-June 1967, and July-August 1967. No debris flows developed during any of the episodes of flooding. In the study of 1956-57 it was episodes of flooding. In the study of 1956-37 it was found that 3 physiographic characteristics influence flooding behavior in a desert stream system: (1) trunk canyon profile; (2) amount of debris on floor of trunk canyon; (3) width of lower canyon and canyon mouth. The most dangerous canyons are steep, narrow, and floored with 5 to 15 ft of unconsolidated debris. The area of greatest of the state of the flooding danger on a desert alluvial fan is a radial zone extending from the apex toward the margin and flanking and including the active channel. (Knapp-USGS)
W69-03222

MAGNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES, Geological Survey, Washington, D. C. H. F. Matthai.

U S Geol Surv Water-Supply Pap 1680, 1968. 491 p, 15 fig, 1 plate, 3 tab, 3 ref.

Descriptors: *Floods, *Flood forecasting, *Data collections, Hydrologic data, Stage-discharge relations, Streamflow, Missouri River, Stream gages. Identifiers: Flood frequencies, Flood measurements, Missouri River basin.

For the Missouri River Basin below Sioux City, Iowa, a means is presented for estimating the magnitude of any flood of any selected frequency between 1.1 and 50 years for both gaged and ungaged sites where the floodflow is not materially affected by regulation or diversion. The ranges in size of drainage basins for which estimates can be made are established by the available base data and are quite different from one part of the study area to another. Within these limits of definition, the frequency of a flood of known magnitude can be estimated. Curves showing the relation between the mean annual flood and a flood of any other frequency between 1.1 and 50 years were defined for eight homogenous flood-frequency regions. The curves of relation between the mean annual flood and contributing drainage area in 21 hydrologic areas were defined. In four of these areas, mean basin elevation was also a factor. Additional curves basin elevation was also a factor. Additional curves are applicable to all or parts of seven large rivers. The regional and areal curves were defined by records for 501 gaging stations and curves for the large rivers were defined by records for 57 gaging stations. Flood records at all streamflow stations having 5 or more years of record through the 1962 water year are compiled in this report. Also, tables showing the maximum known flood at gaging stations and at miscellaneous sites are included. (Knapp-USGS)

HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK, Geological Survey, Washington, D. C. M. A. Warren, Wallace de Laguna, and N. J.

Lusczynski. U S Geol Surv Bull 1156-C, 1968. 127 p, 41 fig, 10 plate, 14 tab, 38 ref.

Descriptors: *Hydrogeology, *Water resources, *Groundwater, *Surface waters, New York, Data collections, Hydrologic data, Streamflow, Aquifers, Water levels, Flow nets, Water sources, Water yield, Specific capacity, Water utilization. Identifiers: Long Island (NY), Upton area, Brookhaven National Laboratory, Well tests.

Streamflow and Runoff—Group 2E

The groundwater and surface water hydrology of the area near Brookhaven National Laboratory, Suffolk County, New York were studied as part of a series of studies of sites for nuclear energy facilities. The area studied includes the Laboratory and extends across the island in a band about 13 mi wide from the Atlantic Ocean to Long Island Sound wide from the Atlantic Ocean to Long Island Sound between longitudes 72 degrees 45' and 73 degrees 00'. Precipitation averages about 45 in. a year evenly distributed throughout the year. The soil and the immediately underlying sediments are generally sandy and highly permeable. Except in periods of intense precipitation there is very little direct overland runoff to streams. Permeable Pleistocene deposits, 100-200 ft thick, constitute the unpermost acuifer. It receives recharge from the uppermost aquifer. It receives recharge from precipitation and discharges mainly into streams, the ocean, and the sound and to a lesser extent into lower aquifers. The lower aquifers, several hundred feet in total thickness, transmit water under arte-sian pressure from the high central part of the island toward its edges where it is discharged into streams or into bodies of salt water. Streamflow is supported throughout the year very largely by groundwater discharge. Water may move from the land surface to the water table at a rate of about 1 to 30 ft per day. Under less favorable conditions it may move 1 ft a day or less. (Knapp-USGS) W69-03232

STREAMS-THEIR DYNAMIO MORPHOLOGY, Antioch Coll., Yellow Springs, Ohio. DYNAMICS AND

Marie Morisawa.

Earth and Planetary Sci Ser Publ, 175 p, 1968. Total 61 fig, 24 plate, 14 tab, 132 ref.

Descriptors: *Geomorphology, *Running waters, *Fluid mechanics, *Hydrology, Graded, Deposition (Sediments), Erosion, Land forming, Channel morphology, Sediment transport, Slopes, River basin development. Identifiers: *Open-channel hydraulics.

A textbook for beginning students of quantitative geomorphology presents the basic principles of fluid mechanics, open-channel hydraulics, and hydrology, as well as some recent work in quantitanydrology, as wen as some recent work in quantitative geomorphology. Detailed explanations are also given of sediment transport, erosion, deposition, slope and channel morphology, graded profile or steady state, channel pattern, and river basin development. Photographs are used to illustrate many natural examples of the topics discussed. No mathematical derivations of the equations used are given; explanations are conceptual whenever possible, and mathematical expressions when needed are presented and briefly explained. (Knapp-USGS)
W69-03248

AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERA-TION OF STREAMFLOW,

Washington Univ., Seattle; and Washington Water Research Center, Pullman.

For primary bibliographic entry see Field 02A. For abstract, see . W69-03307

THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF CYCLE,

California Univ., Davis.
For primary bibliographic entry see Field 02A. For abstract, see W69-03308

WATER RESOURCES DATA FOR KENTUCKY, 1967-PART 1: SURFACE WATER RECORDS. Geological Survey, Louisville, Ky.

Geol Surv Duplicated rep, 1968. 162 p, 2 fig.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Kentucky, Stream gages, Lakes, Reservoirs, Stage-discharge relations.

Identifiers: *Surface water records, Water resources data

The surface-water records for the 1967 water year for gaging stations, partial-record stations, and miscellaneous sites in Kentucky are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. Records are published for the water year which begins on Oct 1 and ends on Sept 30. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The location of the gaging station and the drainage area are obtained from the most accurate maps available. Under 'Records available' are given periods for which there are published records for the present station or for stations generally equivalent to the present one. Under 'Gage' are given the type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available. Information pertaining to the accuracy of the records and to conditions which affect the natural flow at the gaging station is given under 'Remarks.' Daily discharges for the water year are listed in a table. The records also include average discharge, extremes, yearly totals, and peak discharges. (Knapp-USGS) W69-03318

WATER RESOURCES DATA FOR COLORADO, 1967–PART 2. WATER QUALITY RECORDS. Geological Survey, Denver, Colo.

Geol Surv Duplicated rep, 1968. 101 p, 3 fig, 21

Descriptors: *Data collections, *Water quality, *Colorado, Sampling, Gaging stations, Hydrologic data, Water temperature, Sediment discharge. Identifiers: Surface water records, Water resources

Data on the chemical and physical characteristics of the surface waters in Colorado for the 1967 water year are compiled. Water quality information is presented for chemical quality, fluvial sediment, and water temperatures. The chemical quality includes concentrations of individual dissolved constituents and certain properties or characteristics such as hardness, sodium-adsorption-ratio, specific conductance, and pH. Fluvial sediment information is given for suspended-sediment discharges and concentrations and for particle size distribution of suspended sediment and bed material. Water temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. Each sample site description includes location, drainage area, records available, and remarks. (Knapp-USGS)
W69-03319

WATER RESOURCES DATA FOR NEW YORK, 1967-PART 1. SURFACE WATER RECORDS. Geological Survey, Albany, N.Y.

Geol Surv Duplicated rep, 1968. 376 p, 5 fig.

Descriptors: *Data collections, *Surface waters, *Streamflow, *New York, Stream gages, Lakes, Reservoirs, Stage-discharge relations.

Identifiers: *Surface-water records, Water resources data.

The surface-water records for the 1967 water year The surface-water records for the 1967 water year for gaging stations, partial-record stations, and miscellaneous sites in New York are presented. Daily discharge records are given for 284 stream gaging stations. Daily or monthly data on stage or content are given for 42 lakes and reservoirs. Discharge measurements are listed for 562 sites, 144 of which are low-flow partial-record stations, and the remainder are miscellaneous sites. Annual maximum stages and discharges are given for 58 crest-stage partial-record stations. For 48 sites, the annual maximum stages are given. Each station record contains location, drainage area, records available, gage type, average discharge, extremes, remarks, measured discharges and stages, and summary data. (Knapp-USGS) W69-03320

WATER RESOURCES DATA FOR MAS-SACHUSETTS, NEW HAMPSHIRE, RHODE ISLAND, VERMONT, 1967-PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALI-TY RECORDS.

Geological Survey, Boston, Mass.

Geol Surv Duplicated rep, 1968. Total 305 p, 1 fig, 1 plate, 11 ref.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Massachusetts, *New Hampshire, *Rhode Island, *Vermont, *Water quality, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Water temperature, Sediment discharge. Identifiers: Surface water records, Water quality

records, Water resources data.

The surface-water records for the 1967 water year for gaging stations, partial-record stations, and miscellaneous sites in Massachusetts, New Hampshire, Rhode Island and Vermont are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given under Remarks. Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed in a table. Chemical quality, fluvial sediment, and water temperatures are also listed. The chemical quality includes concentrations of individual dissolved constituents, hardness, specific conductance, and pH. Fluvial-sediment information is given for suspended-sediment discharges and con-centrations. Water-temperature data represent centrations. Water-temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes infor-mation from which daily minimums and maximums are obtained. (Knapp-USGS) W69-03321

MONTHLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY, Geological Survey, Washington, D. C.

Conrad D. Bue. Geol Surv open-file rep, Oct 1968. 41 p, 7 fig, 9 tab, 4 ref, 1 append.

Descriptors: *Streamflow, *Estuaries, *Estimating, Virginia, Maryland, Pennsylvania, Diversion, Hydrology, Stage-discharge relations, Stream

gages. Identifiers: Chesapeake Bay inflow.

A convenient and rapid means is presented for estimating monthly or yearly inflow to Chesapeake Bay. The method was developed for the monthly data release 'Estimated stream discharge entering Chesapeake Bay' prepared by the U.S. Geological Chesapeake Bay' prepared by the U. S. Geological Survey in cooperation with Maryland, Pennsylvania, and Virginia and placed in open-file report status, U. S. Geological Survey, for public use. In addition to methodology used in estimating inflow, data on drainage basins and streamflow patterns is included. Estimates of inflow are derived from graphical relations between gaging stations on the 3 major streams entering the bay and the total calculated 10-yr discharge. Tables and graphs show the

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relation between streamflow and total bay inflow. Diversions from and returns to streamflow entering the bay are calculated. An example of the monthly Chesapeake Bay inflow bulletin is attached. (Knapp-USGS)
W69-03325

QUADRANGLE, **FLOODS** IN DYER NORTHEASTERN ILLINOIS, Geological Survey, Washington, D. C.

Howard E. Allen. Geol Surv Hydrol Invest Atlas HA-301, 1 sheet, 1968. 8 fig, 1 map, 2 tab, 3 ref.

Descriptors: *Floods, *Illinois, Stage-discharge relations, Discharge (Water), Profiles, Flood plains, Hydrologic data.
Identifiers: *Dyer (Illinois), Flood frequencies, Flooded area, Flood profiles.

Hydrological data are presented for use in evaluation of the extent, depth, and frequency of flooding in the flood plains in the Dyer quadrangle, northeastern Illinois. A 7 1/2 min topographic map shows the areas inundated by floods. Figures show annual floods above 626.4 ft, frequency-discharge relations, frequency-stage relations, and flood profiles. (Knapp-USGS) W69-03327

FLOODS IN MCHENRY QUADRANGLE, NORTHEASTERN ILLINOIS,

Geological Survey, Washington, D. C. Roman T. Mycyk, and Gerald L. Walter. Geol Surv Hydrol Invest Atlas HA-255, 1 sheet, 1968. 9 fig, 1 map, 3 tab, 3 ref.

Descriptors: *Floods, *Illinois, Stage-discharge relations, Discharge (Water), Profiles, Hydrologic

Identifiers: *McHenry (Illinois), Flood frequencies, Flooded area, Flood profiles.

Hydrological data are presented for use in evaluation of the extent, depth, and frequency of flooding in the flood plains in the McHenry quadrangle, northeastern Illinois. A 7 1/2 min topographic map shows the areas inundated by floods. Figures show annual floods above 736 ft, frequency-discharge relations, frequency-stage relations, and flood profiles. (Knapp-USGS)

LINEAR ANALYSIS OF HYDROGRAPHS,

Geological Survey, Champaign, Ill. For primary bibliographic entry see Field 07C. For abstract, see.

UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING HYDROGRAPH, Cornell Univ., Ithaca, N. Y. Dept. of Water Resources Engineering. D. A. Woolhiser, and J. A. Liggett. Water Resources Res, Vol 3, No 3, pp 753-771, 1967. 19 p, 9 fig, 1 tab, 23 ref.

Descriptors: *Hydrographs, *Mathematical models, *Unsteady flow, *Overland flow, *Synthetic hydrology, Chezy equation, Rainfall-runoff relationships, Mannings equation, Digital com-

puters.
Identifiers: Kinematic wave theory, Boundary conditions, Method of characteristics.

The equations describing overland flow, in 3 nondimensional forms, are solved for the rising hydrograph by finite-difference integration of the characgraph by little-durierence integration of the characteristic equations utilizing a characteristic net. A dry channel was used as an initial condition; the upstream and downstream boundary conditions were zero inflow and critical depth (or no condition for supercritical flow), respectively. A series solution is derived for flow in Zone A, the domain of determinacy of the initial conditions along t= 0. When

compared with previous numerical, analytic, and experimental results, the results show that in general there is no unique dimensionless rising hydrograph for overland flow, but that for most hydrologically significant causes the kinematic wave solution gives very accurate results. A single dimensionless parameter was found to be a suitable criterion for choice between the complete equations or the kinematic wave approximation.

A COMMENT ON HORTON'S LAW OF STREAM NUMBERS,

IBM Watson Research Center, Yorktown Heights, N. Y.

Samuel J. Smart.

Water Resources Res, Vol 3, No 3, pp 773-776, 1967. 4 p, 2 fig, 1 tab, 8 ref.

Descriptors: *Drainage patterns (Geologic), *Tributaries, *Probability, *Statistical models, Mathematical studies, Monte Carlo method, Geomorphology. Identifiers: Hortons laws, Stream numbers,

Branching ratios, Drainage basin characteristics.

Horton's law of Stream Numbers is shown to be in-ternally inconsistent in the following sense: If there exists a large channel network of order S, with stream numbers that satisfy Horton's Law exactly, then the mean stream numbers for lower order networks contained in the large one will show definite deviations from Horton's Law. These mean stream numbers can be expressed by a recursive formula, which involves the probabilities that a stream of order i terminates in a stream of order j greater than i. Reasonable assumptions about the nature of the probability suggest that Horton curves for the small order basins should be concave upwards, a result which is in general agreement with observation. W69-03338

SOME STATISTICAL TOOLS IN HYDROLOGY, Geological Survey, Washington, D. C. For primary bibliographic entry see Field 07B. For abstract, see . W69-03344

MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT METHODS,

Geological Survey, Washington, D. C. For primary bibliographic entry see Field 07B. For abstract, see. W69-03345

GENERAL PROCEDURE FOR GAGING STREAMS

Geological Survey, Washington, D. C. For primary bibliographic entry see Field 07B. For abstract, see.

MICROSESTON DYNAMICS IN A SIERRA NEVADA LAKE-STREAM SYSTEM, Bureau of Sport Fisheries and Wildlife, Bishop, Calif., and California Univ., Davis. Dept. of Zoolo-

J. A. Maciolek, and M. G. Tunzi. Ecology, Vol 49, No 1, Winter 1968. 16 p, 12 fig, 1

Descriptors: *Streams, *Seston, *Organic matter, California, Detritus, Diatoms, Aquatic drift, Eutrophication, Invertebrates, Lakes, Oligotrophy,

Eutrophication, Invertebrates, Lakes, Oligotrophy, Phytoplankton, Primary productivity, Sedimentation, Streamflow, Trophic level, Periphyton, Trout, Chrysophyta, Chlorophyta.
Identifiers: *Sierra Nevada (Calif), *Lake-stream system, *Microseston, Trophodynamics, Laurel Creek (Calif), Laurel Lake (Calif), Mono County (Calif), Sierra Nevada Aquatic Research Lab, Bishop (Calif), Simuliidae, Stephanodiscus, Asterionella, Stream gradient, Allochthonous

sources, Autochthonous sources, Wilderness areas, Diatoma, Synedra, Gomphonema, Spirogyra, Hydrurus, Nostoc.

Microseston (particulate size, 0.45-350 microns) is considered important in Sierra Nevada, Calif, stream trophodynamics. Eight stations along 6.5 kilometers of precipitously descending lake-stream system (Laurel Creek drainage) were sampled. Microsestonic biomass was determined by wet oxidation and its dunamics substant as the state of the stream is called the stream. idation and its dynamics related to system's ecology. Headwaters and seepage sources contained under 2 gcal/liter (= 0.5 mg dry weight/liter) of principally organic detritus. More than 12 gcal/liter appeared in stream as effluent phytoplankton from lake near headwaters, whose influence persisted for 2-3 miles. Cellular microseston's progressive decrease below lake accompanied increased detritus. Increasing percentages of empty diatom (Stephanodiscus) frustules indicated that uptake by non-selectively filter-feeding simulid larvae, which could remove 60% of suspended algae along 0.4 kilometers of stream, accounted for most such losses. Detritus gain resulted from allochthonous vegetation abetted by autochthonous decomposition, including digestion by invertebrates. Sedimentary and physicochemical losses were secondary to trophic removal of seston. Cell destruction by turtrophic removal of seston. Cell destruction by turbulent flow (indicated by persistent intact Asterionella frustules) was proportionate to stream gradient but clearly evident only in gradients prolongedly exceeding 5%. Because loss-causing factors operate selectively on cells, detritus can be expected as chief microseston component in streams isolated from lake outflows. (Eichhorn-Wisc) W69-03359

FACTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO PRECIPITATION IN HUMID AREAS,

Southeastern Forest Experiment Station, Franklin,

N. C.
J. D. Hewlett, and A. R. Hibbert.
Reprint from Proc. Int. Symp. Forest. Hydrol.,
Penn State Univ 1965, 275-290, Pergamon Press,
Inc. New York, 1967.

Descriptors: *Stream hydrographs, *Streamflow forecasting, *Flow characteristics, *Baseflow, *Overland flow, Small watersheds, Precipitation (Atmospheric), Subsurface flow, Hydrograph analysis, Hydrology.
Identifiers: *Hydrologic analysis.

Customary separation of stream hydrographs into overland flow, interflow and baseflow has little meaning when applied to most small watersheds. A revised description of runoff processes in forested headwaters relates quick rises in streamflow to variable source areas and subsurface translatory flow, or the rapid displacement of stored water by new rain. Because this makes the classification of hydrograph components difficult, if not impossible, a numerical rating system, the response factor was developed from precipitation and streamflow records for use in classifying the hydrologic response of small watersheds in humid areas. A response of small watersheds in numid areas. A simple uniform hydrograph separation method was necessary to make inter-watershed and inter-regional comparison of response meaningful. W69-03388

EFFECT OF SEDIMENT LOAD ON THE RAT-ING CURVES OF 0.6-FOOT HS FLUMES, Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Div.; and Minnesota Agricultural Experiment Station, St. Paul. L. F. Hermsmeier, and R. A. Young. U S Department of Agriculture, Agricultural Research Service ARS 41-142, pp 1-10, June 1968. 10 p, 1 dwg, 4 tab, 6 chart.

Descriptors: *Flow measurement, *Sediment load, Flumes, Flow rates, Channels, Sediment discharge, Water measurement, Hydrology, Viscosity, Density stratification, Suspended load.

Streamflow and Runoff—Group 2E

Calibration tests of a standard 0.6-foot HS flume were made using both clear water and sediment-laden water. Corrections to a standard calibration were determined for 1-, 2-, 4-, 6-, 8-, and 12- per-cent sediment in the measured water and flow rates from 0.003 to 0.10 c.f.s. Soil was used as the sediment in the first series of tests and sand was used for a second series. The sediment-laden water caused measurement errors up to 30 percent when a standard calibration curve was used with a 0.6foot HS flume. Difference in stage height caused by sediment in the measured water were largely caused by changes in the slope and the elevation of the floor of the flume and approach channel. Errors because of changes in viscosity and density of the measured water caused by suspended sediment were negligible. W69-03403

DIVISION S-6-SOIL AND WATER MANAGE-MENT AND CONSERVATION-LEVEL PAN SYSTEM FOR SPREADING AND STORING WATERSHED RUNOFF, Central Great Plains Field Station, Akron, Colo.

Rome H. Mickelson.

Soil Sci Soc Amer Proc, Vol 30, No 3, pp 388-392, May-June 1966. 5 p, 4 fig, 2 tab.

Descriptors: Rainfall, *Water spreading, *Surface runoff, Colorado, Watersheds (Basins), *Water storage, *Dry farming, Runoff, Water management (Applied), Moisture availability, Water conservation, Soil moisture, Feasibility studies, Crop production, Semiarid climates. Identifiers: Pan system.

At Akron, Colorado, a level pan system was designed and contructed in broad natural waterways to intercept runoff from contributing watersheds for storage and crop use. The objectives were to evaluate feasibility of utilizing watershed runoff on dryland level areas for annual crop production, response of different crops to intermitproduction, response of different crops to intermit-tent flooding and some water management problems involved in the spreading system. Amounts and depth of moisture in level pans receiving runoff during 7 to 9 months of storage was almost equivalent to that on fallow after 19-21 months. Moisture storage in level pans was twice as effective as that for unleveled and leveled check areas of continuous cropping. Level pans increased total moisture supplies 3.5-7.0 inches annually, most of which originated from runoff. Although runoses noff was sometimes heavily laden with sediments, deposition had not been serious. Level pans could be constructed in arid climates in order to increase water use efficiency with respect to water spreading and storing watershed runoff. (Blecker-Ariz) W69-03499

NORTHWOOD GAGING INSTALLATION, BAL-1 IMORE-INSTRUMENTATION AND DATA, American Society of Civil Engineers Program Office, Cambridge, Mass.

L. S. Tucker.
ASCE Tech Mem No 1, Urban Water Resources
Res Program, Aug 1, 1968. 16 p, 11 fig, 2 tab, 3 append. OWRR: 14-01-0001-1585 and USGS-14-08-0001-11257.

Descriptors: *Rainfall-runoff relationships, *Data collections, *Storm runoff, *Urbanization, Watersheds (Basins), Stream gages, Flumes, Rain gages, Land use, Discharge (Water), Runoff, Hydrographs, Hyetographs, Evaporation, Rainfall. Identifiers: *Urban hydrology, Parshall flumes, Baltimore (Md).

Detailed data of the hydrology of Northwood, a small urban drainage area in Baltimore, Maryland, are presented. Northwood is one of the few sewered catchments in the U. S. that is gaged with flumes. The 47.4 acre drainage area is about 4 mi north of downtown Baltimore in a residential suburban area. It contains a 17.4 acre shopping center and 30 acres of residential development. Buildings in the residential area are very uniformly grouped

houses with 3-4 houses per group. The average imperviousness of the drainage area is 68%. Ground slopes average 3%. A weighing bucket rain gage and a Parshall flume were installed in 1959, and the rain gage was replaced with a tipping bucket gage in 1963. Both in the rain gage and stream gage have recorders. Runoff is estimated to be within 5% of actual flow 95% of the time for flume depths over 4 in. Reduced rainfall and runoff data for 14 storms, hourly precipitation, and daily pan evaporation data are tabulated. Hyetographs and hydrographs illustrate the rapid response of the drainage area. (Knapp-USGS) W69-03507

GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA, American Society of Civil Engineers Program Office, Cambridge, Mass. L. S. Tucker.

ASCE Tech Mem No 2, Urban Water Resources Res Program, Aug 15, 1968. 14 p, 8 fig, 2 tab, 2 append. OWRR: 14-01-0001-1585, USGS: 14-08-

Descriptors: *Data collections, *Storm runoff, *Rainfall, *Rainfall-runoff relationships, *Urbanization, Watersheds (Basins), Stream gages, Flumes, Rain gages, Land use, Drainage, Discharge (Water), Runoff, Hydrographs, Hyetographs,

Identifiers: *Urban hydrology, Parabolic flumes, Chicago (Ill), Oakdale (Chicago).

An instrumented 12.9 acre urban drainage area in Chicago, Illinois is described. Rainfall and runoff data for storms for which data are reliable are tabulated and presented. The area is 2 1/2 blocks by 1 block wide and consists entirely of detached family dwellings. The drainage system is a 30-in. combined sewer draining into a 10.5 ft square concrete trunk sewer. Runoff is measured by a parabolic flume in an underground vault. A tipping bucket rain gage is located about 1 block north of the drainage area. The rain and flume gages are connected to recorders by telephone lines. Rainfall and runoff records from storms are shown in tables, hyetographs, and hydrographs. Copies of some of the original recorder charts are included. (Knapp-USGS) W69-03508

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS,
Florida Univ., Gainesville. Dept. of Environmental

Engineering. For primary bibliographic entry see Field 07A. For abstract, see . W69-03509

THE NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR IMPORTANCE IN THE DECADES AHEAD, American Society of Civil Engineers Program Office, Cambridge, Mass. For primary bibliographic entry see Field 04C. For abstract, see .

W69-03511

SLOPE-DISCHARGE RELATIONS FOR EIGHT RIVERS IN THE UNITED STATES,

Geological Survey, Washington, D. C Charles W. Carlston. Geol Surv Res 1968, Prof Pap 600-D, pp D45-D47, 1968. 3 p, 4 fig, 1 ref.

Descriptors: *Discharge (Water), *Streamflow, *Hydrographs, Graded, Delaware River, Missouri

Identifiers: Slope-discharge relationships, Arkansas River, Susquehanna River, Red River, Alabama

Graphs showing slope versus mean annual discharge have been prepared for 8 rivers in the

United States, and eye-fitted lines were constructed for those rivers showing acceptable statistical cor-relation of slope with discharge. Two alluvial-bed graded rivers, the Red River of Louisiana and Arkansas and the Arkansas River, showed a very close correlation of slope varying with discharge. A third river, the Missouri, showed a slope-discharge relation of slope unrelated to discharge for more than 1,800 mi upstream from its mouth. Two other rivers, the Tennessee-Holston and the Delaware, showed a good correlation of slope with discharge. The remaining 3 rivers- the Ohio, the Susquehanna, and the Alabama and its headwaters-showed no correlation of slope plotted against discharge. (USGS) W69-03521

AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W., Sydney Univ. (Australia). Dept. of Geography. For primary bibliographic entry see Field 02F. For abstract, see. W69-03532

CALIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT METERS, Geological Survey, Washington, D. C. For primary bibliographic entry see Field 07B. For abstract, see . W69-03536

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILATION OF BASIC DATA-1966,

Geological Survey, Austin, Tex. For primary bibliographic entry see Field 04C. For abstract, see. W69-03538

FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND TRIBUTARIES IN MARION AND POLK COUNTIES, OREGON, Corps of Engineers, Portland, Oreg.

Corps of Eng Flood Plain Rep, 2 Vol, May-June 1968. Total 88 p text, 12 fig, 95 plate, 22 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, Flood control, Non-structural alternatives, Oregon, Maximum probable flood. Identifiers: Marion County (Oregon), Polk County (Oregon), Willamette River (Oregon), Santiam River (Oregon), Luckiamute River (Oregon), Standard project flood.

Flooding of the Willamette River and its tributaries in Marion and Polk Counties, Oregon, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulation, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS) W69-03539

CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,

International Atomic Energy Agency, Vienna (Austria). For primary bibliographic entry see Field 07B.

For abstract, see . W69-03544

DECEMBER 1964, A 400-YEAR FLOOD IN NORTHERN CALIFORNIA, Geological Survey, Menlo Park, Calif. Edward J. Helley, and Valmore C. LaMarche, Jr.

Field 02—WATER CYCLE

Group 2E—Streamflow and Runoff

Geol Surv Res 1968, Prof Pap 600-D, pp D34-D37, 1968. 4 p, 3 fig, 5 ref.

Descriptors: *Floods, *California, *Historic flood, Flood damage, Alluvium, Radioactive dating, Dendrochronology.

Identifiers: Blue Creek (Cal), Klamath River (Cal), 400-year flood, Flood frequencies, Tree-ring

Twice in the past 13 yr, recordbreaking floods have occurred over large areas of northern California. The true long-term recurrence intervals of these destructive floods is difficult to estimate by conventional flood-frequency analysis because prediction of a given flood discharge is based on historical records of flood peaks. Geomorphic and botanical evidence of a major prehistoric flood has been investigated on Blue Creek, a tributary to the Klamath River in northern California. Radiocarbon analysis, supplemented by tree-ring counts, established a date about 400 yr ago of a flood event that had approximately the same order of magnitude as the devastating floods of December 1964. W69-03560

THE USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW SYNTHESIS,

Geological Survey, Washington, D. C. For primary bibliographic entry see Field 02A. For abstract, see . W69-03562

FLOOD HEIGHT-FREQUENCY RELATIONS FOR THE YLAINS AREA IN MISSOURI, Geological Survey, Rolla, Mo.

E. Eugene Gann.
Geol Surv Res 1968, Prof Pap 600-D, pp D52-D53, 1968. 2 p, 2 fig, 3 ref.

Descriptors: *Stage-discharge relationships, *Flood forecasting, Streamflow forecasting, Missouri, Floods, Flood plains, Drainage areas. Identifiers: *Flood high-frequency-drainage area-relations, Recurrence intervals, Peak stages, Flood

Regional relations are defined for estimating the heights of floods having recurrence intervals ranging from 1.2 to 50 years at natural flow sites in the plains area of Missouri. Drainage-area size is the only independent variable required. Average standard errors of the relations range from 21% for the 50- and 25-year floods to 35% for the 1.2-year flood. A method is presented for utilizing the relations at ungaged sites. (USGS) W69-03563

STREAMFLOW ROUTING (WITH APPLICA-

TIONS TO NORTH CAROLINA RIVERS), North Carolina State Univ., Raleigh. Dept. of Civil Engineering; and North Carolina Univ., Chapel

Michael Amien, and Ching Seng Fang. N C Univ Water Resources Res Inst Rep No 17, Jan 1969. 72 p, 20 fig, 3 tab, 19 ref. 14-01-0001-1401, OWRR Proj A-001-NC.

Descriptors: *Routing, *Flood routing, *Unsteady flow, *Numerical analysis, *Digital computers, *Computer programs, Mathematical studies, Backwater, Floods, Open channel flow, Streamflow forecasting, Hydraulics, North Carolina, Runoff. Identifiers: Mass conservation equations, Momentum conservation equations, Iteration methods, Neuse River (N.C.), Implicit methods.

The unsteady flow of water was studied, particularly in relation to the planning, design, and management of water resources when computations must be made on flood flows, reservoir regulation, surges in canals, and tidal flow. The equations of conservation of mass and momentum are powerful analytical tools for the investigation of unsteady flows. Although approximate solutions of

these equations are often used, the digital computer makes it feasible to obtain complete solutions of the equations by numerical methods. In this study, the explicit, characteristic, and implicit methods were investigated in detail and were ap-plied to artificial and natural channels. The natural channel selected for this purpose was a reach of the Neuse River, North Carolina. Even though the three methods provided almost identical solutions, their speed, reliability, simplicity, and convenience are different. The implicit method, as developed from this study, proved to be fast, accurate, and convenient, and highly suitable for problems involving flow in natural river channels of complex geometry. The advantages of the implicit method make it feasible to use this sophisticated tool for the solution of unsteady flow problems in a routine manner. (Knapp-USGS) W69-03564

AN EMPIRICAL FORMULA FOR DETERMIN-AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS, Geological Survey, Cheyenne, Wyo. For primary bibliographic entry see Field 07C.

For abstract, see . W69-03565

OF SMALL FLOOD HYDROLOGY OF SMALL WATERSHEDS-EVALUATION OF TIME PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,

Hawaii Univ., Honolulu. I-pai Wu. Contrib No 13, Dec 1968. ASAE Paper No 68-711, 33 p, 14 fig, 2 tab, 19 ref. OWRR Project B-006-HI.

Descriptors: *Peak discharge, *Flood hydrograph, *Linearity test, *Hawaiian small watershed,

Hawaiian small watersheds are small and steep. Both of the two hydrograph time parameters, time to peak and recession constant, are short. The shape of the flood hydrograph is a steep triangle and most likely produced by a short duration, high intensity rainfall. Peak discharge equations which are derived by three different approaches, triangular hydrograph, instantaneous unit hydrograph, and overland flow analysis, can all be shown as a simple equation, Op=CAR. A linearity test between peak discharge and runoff has been made for the small watersheds and a good linear relationship was found between peak discharge and for runoff less than 6 inches. than 6 inches.

2F. Groundwater

POTENTIAL FLOW AND SOIL STRUCTURE

CHANGES,
Slovak Technical Univ., Bratislava (Czechoslovakia).
P. Peter, and J. Hulla.
Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 168-170, 1967. 3 p, 4 fig, 1 tab.

Descriptors: *Soil water movement, *Water level fluctuations, *Soil structure, *Potential flow, Flow characteristics, Permeability, Model studies, Fine-textured soils, Sands, Gravels, Leaching, Transmissivity, Structures, Dam failure. Identifiers: *Soil structure change, *Piping.

Changes in soil structure due to water level fluctuation are described. Field and laboratory studies showed that rapid changes in the groundwater level and of the horizontal flow pattern caused the fines to wash out of the gravel sands which changed both their structure and permeability values. A difference of up to 250-fold occurred in permeability between disintegrated and sand-enriched soils. Use of the potential flow equation shows that high pressures are transmitted through the disintegrated soil to distances of several hundred meters and can

cause a piping and leaching effect, endangering hydraulic structures such as dams. (Lang-USGS) W69-03203

SEEPAGE FROM A CANAL INTO SOIL WITH SHALLOW WATER DEPTH,

Kyoto Univ. (Japan). K. Akai, and T. Uno.

Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 131-134, 1967. 4 p, 12 fig, 2 ref.

Descriptors: *Seepage, *Canals, Mathematical models, Hydraulic models, Recharge, Water level fluctuations, Groundwater movement, Lakes, Soil moisture.

Identifiers: *Seepage models.

Seepage from canals underlain by high water tables was studied with 2 mathematical models of flow systems, and verified by sand model tests. A method for estimating the free surface position and rate of recharge was derived. The rate of rise of the free water surface in the direction opposite the regional groundwater flow direction is nearly proportional to the rate of recharge, and a 'curtain' or line of no net upstream recharge occurs under the canal. (Knapp-USGS) W69-03204

ANALYSIS OF SOME PUMPING TEST RESULTS.

Nottingham Univ. (England). Dept. of Civil Engineering. E. W. Brand.

Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 139-144, 1967. 6 p, 12 fig, 2 tab, 9 ref.

Descriptors: *Groundwater movement, *Drawdown, *Theis equation, *Thiems equation, Pumping, Testing, Test procedures, Dupuit-Forchheimer

Identifiers: *Well testing, Pumping tests, Cone of depression, Chow method, Cooper and Jacob method, Boulton method.

Four pumping tests carried out in Antwerp were analyzed by a number of methods with a view to quantitative assessment of the formation constants of the unconfined sand aquifer. The wells were pumped at a nearly constant rate for the first 4 hours and water levels were read at short intervals. Water levels were then read at longer intervals until apparent equilibrium was reached. Equilibrium discharge and water level were recorded after 30 days in 4 of the wells. Data were analyzed by the Thiem equilibrium method and the Theis, Cooper and Jacob, Chow, and Boulton non-equilibrium methods. Some explanation is given of the basic principles of the analyses, and the methods are compared in respect of their applicability and ease of use. The numerical results computed from the tests indicate that permeabilities of the right order can be predicted by most of the techniques, but that more exact agreement cannot in general be achieved. The simpler techniques appear, at the present time, to have definite practical advantages over those resulting from more sophisticated mathematical treatment of the problem. (Knapp-USGS) W69-03206

ON THE MECHANISM OF SUSPENDED CAPILLARY WATER AND PERCHED GROUND-

Akademiya Nauk Armyanskoi SSR, Erevan. Institut Geologicheskikh Nauk. G. Ter-Stepanian.

Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 179-181, 1967. 3 p, 2 fig.

Descriptors: *Capillary water, *Perched water, Unsaturated flow, Soil water movement, Landslides, Capillary action, Groundwater.

Groundwater—Group 2F

Identifiers: Perched groundwater, Capillary

The properties of capillary systems and the equilibrium of capillary fluids with the surrounding porous media are used to explain the behavior of suspended capillary water and temporary perched water horizons. The significance of the curvature of the menisci, and the gravitational potential of piezometric levels in these systems, are stressed. Based on this theory, the features of formation and evolution of suspended capillary water in different types of soils are explained. It is shown that the temporary perched groundwater horizons may not be in equilibrium with the stationary horizons below. A possible type of migration of suspended capillary water is illustrated by capillary siphoning, and the possibility of landslides due to it is indicated. (Knapp-USGS) W69-03208

CHARACTERISTICS OF SUBSURFACE WATERS HAVING A TENDENCY TO PRECIPITATE IN THE FILTER ZONES OF WELLS, V. S. Alekseyev.

Transl from Doklady Vodgeo No 13, pp 133-143, 1966. Soviet Hydrol: Selec Pap, Issue No 4, pp 410-415, 1967. 6 p, 3 fig, 4 tab, 4 ref.

Descriptors: *Well filters, *Chemical precipitation, *Water chemistry, Coagulation, Corrosion, Hydrogen ion concentration, Iron, Manganese, Calcium, Silica, Clays, Groundwater. Identifiers: Well screen clogging, USSR.

A method is given for predicting the clogging of well screens by chemical reactions caused by disturbance of chemical equilibrium due to the presence of wells. The common clogging materials are calcium carbonate, silica, particles, and oxides and hydrates of Fe and Mn. To predict the stability of waters when they are disturbed by wells, it is most convenient to use pH, ionic concentrations and partial pressure of carbon dioxide in nomographs and equations which yield a saturation index J= actual pH - stable pH. Iron near wells may stay in ionic solution or form colloidal suspensions depending on iron concentration and pH; above a pH of about 6-8 in oxidizing conditions, particularly in the presence of iron bacteria, clogging is probably in many natural waters. Examples are given of 2 wells of different saturation indexes. (Knapp-USGS) W69-03210

CONVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN RELATION TO PROTECTION OF SUBSURFACE RS FROM CONTAMINATED WATERS DISCHARGES,

For primary bibliographic entry see Field 05B. For abstract, see . W69-03212

HYDROLOGIC SUBSTANTIATION AND COM-PUTATION OF THE REDUCTION OF FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS AFTER UNDERFLOODING IN RIVER SYSTEMS, For primary bibliographic entry see Field 02A. For abstract, see . W69-03214

INVESTIGATION OF WATER ABSORPTION BY THE SOIL ON THE BASIS OF THE DIMEN-SIONAL THEORY,

For primary bibliographic entry see Field 02G. For abstract, see . W69-03215

FATE OF DDT AND NITRATE IN GROUND WATER.

Robert S. Kerr Water Research Center, Ada, Okla.; and Southwestern Great Plains Research Center, Bushland, Tex.

For primary bibliographic entry see Field 05B. For abstract, see . W69-03219

FLOW OF GROUNDWATER IN RELATIVELY THICK LEAKY AQUIFERS,
New Mexico Inst. of Mining and Technology,

Mahdi S. Hantush.

Water Resources Res, Vol 3, No 2, pp 583-590, 1967. 8 p, 2 fig, 12 ref.

Descriptors: *Groundwater movement, *Aquifers, *Leakage, Artesian wells, Water wells, Aquifer characteristics

Identifiers: Hydrologic systems, Leaky aquifers, Aquifer leakage factor.

Solutions to many problems of flow in leaky aquifers are based on a differential equation that includes a leakage term in addition to the usual terms of the equation of groundwater motion. In other words, the effect of leakage on the flow is incorporated in the differential equation rather than expressed as a boundary condition, as it actually occurs in the physical system. Such an approximation is justified when the main aquifer is relatively thin, provided, of course, that the conductivity of the semipervious layer relative to those of the main aquifers of the leaky system is small. Although the latter condition is almost always prevalent in nature, real aquifers are not always relatively thin. In thick aquifers, the use of the available solutions may yield poor results, especially when a quantitative criterion for the relative thickness of the aquifers is not available. Solutions are developed by using the usual differential equation of groundwater motion and the pertinent initial and boundary conditions, expressing the effect of leakage on the flow as a boundary condition. Moreover, a quantitative criterion is established for the applicability of the solutions that are already available from the approximate theory now in use. The already available solutions appear to be applicable wherever thickness to leakage factor is less than about 0.10. (Knapp-USGS) W69-03220

GROUND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON, Geological Survey, Washington, D. C. Henry W. Anderson, Jr. Wash State Dep Nat Resources Water-Supply Bull No 25, Part 2, 1968, 317 p, 18 fig, 4 plate, 12 tab, 12 ask 12 ref, 1 append.

Descriptors: *Water resources, *Groundwater, *Washington, Aquifers, Hydrologic data, Data collections, Water yield, Water quality, Water levels, Water level fluctuations, Observation wells, Hydrogeology.
Identifiers: *Island County (Wash).

The groundwater resources of Island County, Washington, are the only significant water supply of a population of over 22,000. Average annual precipitation ranges from 20 to 40 in. and is the precipitation ranges from 20 to 40 in. and is the only recharge to groundwater. The aquifers are Pleistocene deposits from 3 glacial and 3 interglacial periods. Most of the water is produced from depths within 20 ft of sea level. A few draw water from deeper zones, down to 400 feet below sea level. Most of the wells are shallow; 18% are 200-300 ft deep and only 3% are more than 300 ft deep. Average yields range from 20 gpm in shallow wells to 80 gpm in deeper wells. Dissolved solid content of well water ranges from less than 300 mg/d to over 1000, and hardness from 50 to over 800. Total withdrawal is estimated to be about 1 billion gal per yr. About 60% is used for domestic and public supplies, 25% for irrigation, and 15% for stock and industrial purposes. Water levels fluctuate less than 2 ft in 50% of observation wells, but there is some seawater encroachment in a few heavily pumped locations. (Knapp-USGS) W69-03224

DEUTERIUM CONTENT IN NATURAL WATERS.

Institut Prikladnoi Geofiziki, Leningrad, Trudy (USSR). For primary bibliographic entry see Field 02K. For abstract, see.

SHORTCUTS AND SPECIAL PROBLEMS IN

W69-03229

AQUIFER TESTS, Geological Survey, Washington, D. C For primary bibliographic entry see Field 07B. For abstract, see .

HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK, Geological Survey, Washington, D. C.

For primary bibliographic entry see Field 02E. For abstract, see . W69-03232

USE OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA, For primary bibliographic entry see Field 07B.

For abstract, see. W69-03235

GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN NORTHEAST-ERN ILLINOIS,

Illinois State Geological Survey, Urbana For primary bibliographic entry see Field 05B. For abstract, see . W69-03236

NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,

Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab. For primary bibliographic entry see Field 05B. For abstract, see . W69-03237

HYDROGEOLOGY OF DESERT BASINS,

Nevada Bureau of Mines, Reno. Desert Research

George B. Maxey. Ground Water, J Tech Div Nat Water Well Ass, Vol 6, No 5, pp 10-22, Sept-Oct 1968. 13 p, 15 fig, 29 ref.

Descriptors: *Hydrogeology, *Deserts, *Ground-water basins, Nevada, Water law, Planning, Model studies, Water chemistry, Water management (Ap-

Identifiers: Desert Research Institute.

The groundwater flow patterns of desert basins, which usually involve recharge in mountains and discharge in lowlands, are reviewed and illustrated by some detailed studies in the Great Basin of Nevada. In the Great Basin two general categories of groundwater flow systems are recognized: (1) local flow systems where drainage areas are usually small, flow paths are relatively short, interbasin small, flow paths are relatively short, interbasin flow is uncommon, springs have large fluctuations in discharge, water temperature is low, and concentration of Na, K, Cl, and SO4 is low, and (2) regional flow systems, where drainage areas are large, flow paths long, interbasin flow common, springs have large discharge, and the water is characteristically of higher temperature and contains higher concentrations of K, Na, Cl, and SO4. Although

Field 02-WATER CYCLE

Group 2F-Groundwater

detailed delineation of most flow systems in Nevada has not been accomplished, integration of hydrologic, geologic, and chemical methods allow approximate portrayal of many systems, both local and regional. Adequate methods upon which to base planning for optimum development of water resources in desert basins are now available. A conceptual model of optimal groundwater reservoir development illustrates how to determine optimum use of storage and perennial yield provided the use to which the water is to be put and the time of withdrawal are known. (Knapp-USGS)

EXPLANATION OF PARADOXES IN DUPUIT-

FORCHHEIMER SEEPAGE THEORY, lowa State Univ., Ames. Water Resources Research Inst Don Kirkham.

Water Resources Res. Vol 3. No 2, pp 609-622, 1967. 14 p. 10 fig. 29 ref.

Descriptors: *Groundwater movement, *Dupuit-Forchheimer theory, *Mathematical studies, Seepage, Porous media, Hydraulics, Water table, Sediment yield, Flow nets.

Identifiers: Seepage flow, Nonorthogonal flow nets. Streamlines

Cutting into a porous medium of a large number of vertical, parallel, infinitely permeable, equally spaced, infinitesimally thin slots produces a fictispaced, infinitesimally diffusion produces a ficu-tious soil that follows exactly and without paradoxes Dupuit's assumptions and hence Dupuit-Forchheimer (D.F.) drainage theory in two dimen-sions. A soil having these infinitesimally thin slots is designated a D. F. soil. For this fictitious soil, a formula for the proper depth and spacing of ditches and drain tiles is derived. The formula is the same one found in conventional D. F. literature. The formula, valid for both tiles and ditches and known to mula, valid for both tiles and ditches and known to hold approximately for actual soils, is exact for a D. F. soil. Dupuit's 2-dimensional 'parabolic seepage problem' and others may now be considered as ex-actly solvable for D. F. soils. For 3-dimensional axially symmetric seepage flow, as into wells, the ficti-tious slots of a D. F. soil become concentric coaxial rings. D. F. streamlines are not horizontal; they converge in a special way. (Knapp-USGS) W69-03242

THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUB-SURFACE PERMEABILITY VARIATION,

SURFACE PERMEABILITY VARIATION,
Department of Mines and Technical Surveys, Calgary (Alberta). Water Research Branch; and
California Univ., Berkeley. Dept. of Civil Engineer-

R. Allan Freeze, and P. A. Witherspoon. Water Resources Res, Vol 3, No 2, pp 623-634, 1967. 12 p, 6 fig, 8 ref.

Descriptors: *Groundwater movement, *Steady flow, *Regional analysis, *Mathematical models, *Digital computers, Water table, Discharge (Water), Anisotropy, Topography, Stratigraphy, Identifiers: Drainage basin characteristics.

Details of steady-state flow in regional groundwater basins can be investigated using digital computer solutions of appropriately designed mathematical models. The factors that must be considered are: (1) ratio of depth to lateral extent of the basin; (2) water-table configuration; and (3) stratigraphy and resulting subsurface variations in permeability. The results of this study provide a theoretical basis for the following properties of regional flow systems: (1) groundwater discharge will tend to be concentrated in major valleys; (2) recharge areas are invariably larger than discharge areas; (3) in hummocky terrain, numerous subbasins are superposed on the regional system; (4) buried aquifers tend to concentrate flow toward the principal discharge area, having a limiting effect on subbasins, and need not outcrop to produce artesian flow conditions; (5) stratigraphic discontinuities can lead to

distributions of recharge and discharge areas that are difficult to anticipate and that are largely independent of the water-table configuration. (Knapp-USGS) W69-03243

ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES, Nauchno-Issledovatelskii Institut

Vsesoyuznyi Nauchno-issiedovateiskii Institut Yademoi Geofiziki i Geokhimii, Moscow (USSR). V. N. Soyfer, V. S. Brezgunov, and L. S. Vlasova. Transl from Geokhimiya, No 5, 1967 (Russian). Geochem Int, Vol 4, No 3, pp 490-497, 1967. 8 p, 4 fig. 4 tab, 19ref.

Descriptors: *Deuterium, *Stable isotopes, *Hydrologic cycle, Water analysis, Aquifers, Evaporation, Surface waters, Groundwater, Meteoric water, Geochemistry, Hydrogen,

Hydrogeology.
Identifiers: USSR, fractionation. Isotope Photoneutron analysis. Mass spectrometric analy-

Data are presented on the distribution of deuterium in natural waters in the USSR. Determinations were made by photoneutron and mass spectrometric analysis of over 500 water samples. The highest deuterium concentrations are characteristic of ocean water, and the lowest, of glacier ice and meteoric waters (particularly snow). The concentration of deuterium in groundwaters is intermediate between the concentrations in ocean and meteoric waters. Deuterium content in river and open basin waters varies with the hydrologic region, but within the same limits as in other waters. These data form a base for investigating the dynamics and origin of underground water. Conclusions are presented on the decisive influence of evaporation and condensation processes in the world-wide hydrologic cycle on the deuterium distribution in natural waters, including underground waters. (Steinhilber-USGS)
W69-03244

FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN ILLINOIS, Illinois State Geological Survey, Urbana. For primary bibliographic entry see Field 05E. For abstract, see . W69-03251

ON THE MEANING OF THE DUPUIT AND PAVLOVSKII APPROXIMATIONS IN AQUIFER

FLOW, Technion-Israel Inst. of Tech., Haifa.

S. Irmay. Water Resources Res, Vol 3, No 2, pp 599-608, 1967. 10 p, 4 fig, 17 ref.

Descriptors: *Groundwater movement, *Dupuit-Forchheimer theory, *Mathematical studies, Laplaces equations, *Hydraulics.
Identifiers: Hydraulic flow.

Pavlovskii's method is applied to Dupuit's approximate solution of steady hydraulic flow of unconfined 2-dimensional plane or curved aquifers in uniform or nonuniform soils, on a horizontal or inclined impervious base. Graphs correlate the geometrical parameters. The error on the potential is about 1/4%. The effect of end slopes, especially of the seepage face, may account for some 30% of the total discharge. In 1-dimensional flow the discharge is correct even in nonuniform and curving aquifers on a horizontal base and seemingly also on an inclined base. Girinskii's potential in nonuniform soils in Dupuit's approximation is replaced in the exact theory by two other potentials. (K-w69-03252

APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER

QUALITY, CALIFORNIA. MOJAVE RIVER VALLEY.

Geological Survey, Menlo Park, Calif. D. R. Dawdy, and J. H. Feth.

Water Resources Res, Vol 3, No 2, pp 505-510, 1967. 6 p, 1 fig, 3 tab, 9 ref.

Descriptors: *Water chemistry, *Geochemistry, *Groundwater, *Statistical methods, California, Aqueous solutions, Equilibrium, Correlation analy-

Identifiers: Factor analysis, Mojave River (Califor-

Factor analysis is applied to results of chemical analyses of 103 water samples from wells in the Upper and Middle Mojave River valley, San Bernardino County, California. Chemical analyses showed that there are 3 principal chemical types of water, calcium bicarbonate, sodium sulfate, and sodium chloride, as well as many mixtures of the three. Data were studied by factor analysis to learn the relative importance of each principal ion in determining the variations among the samples, and to examine the possibility of chemical equilibrium between aqueous and solid phases in the aquifers. Most of the covariance in the system may be ac-counted for by variances of calcium, magnesium, sodium, sulfate, and chloride. There is almost identical loading on the constituents sodium and chloride. The variance in chemical composition of the hydrochemical system is governed largely by sources of sodium chloride. None of the components is controlled by equilibrium between ions in the water and minerals in the aquifers. Concentrations of nitrate and fluoride vary independently of other constituents. Geographic distribution of statistical loadings of the principal constituents at individual wells does not reveal sources of the constituents, which must be deduced from geologic and hydrologic evidence. Factor analysis, however furnished the critical information on chemical relationships basic to the deduction. (Knapp-USGS) W69-03253

USE OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT FLOW TO A PARTIALLY PENETRATING WELL, California Univ., Berkeley. Dept. of Civil Engineer-

ing.
I. Javandel, and P. A. Witherspoon.
Water Resources Res, Vol 3, No 2, pp 591-597,

Descriptors: *Groundwater movement, *Unsteady flow, *Discharge (Water), *Model studies, *Heat flow, Penetration Identifiers: Partially penetrating wells, Thermal

A thermal model constructed from a slab of steel was used to investigate the theory of transient flow to a partially penetrating well in a confined aquifer of infinite radial extent where there is no leakage. Families of type curves have been prepared from the theoretical solution for tenth, quarter, and half penetration. Experimental results from the thermal model using the same penetrations are generally in very good agreement with the appropriate theoreti-cal solution. This demonstrates the usefulness of cal solution. This demonstrates the usefulness of the thermal model in studying transient flow problems. It is concluded that this experimental work has provided independent proof of the validity of the theoretical solution for the effects of partial penetration. (Knapp-USGS) W69-03254

DICKEY V HONEYCUTT (MINE DAMAGE TO WELLS).

106 So 2d 665-670 (Ct App Ala 1958).

Descriptors: *Alabama, *Wells, *Mining, *Percolating water, Judicial decisions, Deep wells, Underground, Land subsidence, Water law, Water

Groundwater—Group 2F

Plaintiff sued for damage to a water well resulting from defendant's mining operations. Two tunnels of the mine came within a short distance of the plaintiff's property line. According to applicable law, if the defendant drained percolating water when using his land in a careful and ordinary manner, and a surface owner's water supply is affected, no liability for his damage exists. However, if he drained the water without a reasonable need to do so, or if he negligently or willfully wasted percolating water through drainage in such a manner that he should have anticipated damage to a water supply would occur, then he is liable to injured surface owners if his action was a proximate cause of their damages. The court found that the plaintiff's well was damaged as the proximate result of the defendant's negligence. (Scott-Fla) W69-03282

ANALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.

Herman Bouwer.

Water Resources Res, Vol 3, No 3, pp 897-907, 1967. 11 p, 8 fig, 17 ref.

Descriptors: *Analog models, *Computer models, *Analog computers, *Groundwater movement, *Porous media, Digital computers.

Identifiers: Hydrologic Boundary problems.

The analysis of subsurface movement of water by electric analog methods is discussed and examples of analog systems are given. Direct analogs simulate the transmission and storage properties of the soil as relevant parameters in the water movement process. Principles and techniques for constructing and operating analogs include calculation of recapacitance values for network analogs, simulation of fixed, free, and infinite boundaries, inclusion of unsaturated flow, solution of quasi-steady flow problems, analysis of diffusiontype flow systems, simulation of horizontal and vertical flow systems, instrumentation, and data conversion. Direct electric analogs are relatively simple to build and use, and they enable solution of flow systems not amenable to mathematical analysis. There is, however, a limit as to the complexity of flow systems that direct analogs can handle, and a point is reached where digital computers are more appropriate. W69-03310

AN AQUIFER TEST USED TO INVESTIGATE A

QUALITY OF WATER ANOMALY, Geological Survey, Huron, S. Dak. Resources Div.
Donald G. Jorgensen.

Ground Water, Vol 6, No 6, pp 18-20, Nov-Dec 1968. 3 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Water quality, *Groundwate Aquifers, Artesian wells, South Dakota, Leakage. Identifiers: Aquifer tests, Avon (South Dakota). *Groundwater.

An aquifer test and analyses of water samples showed that the anomalous quality of water in a municipal well in Avon, South Dakota was caused municipal well in Avon, South Dakota was caused by leakage from a nearby abandoned well tapping another aquifer. The test used the city well and I observation well. Analysis of test data indicated a transmissibility of 450 gpd per ft before the cone of influence reached the recharge boundary and 1700 gpd per ft after reaching it. A graphical method located an image well in about the same area as a 50 yr old capped city well. The abandoned well was finished in the Dakota aquifer, which has a higher potentiometric surface than the Codell aquifer, in which the city well is finished. Leakage of the caswhich the city well is finished. Leakage of the cas-ing of the old well is furthur indicated by chemical quality of the water, which has about the composi-tion and temperature of a mixture of Codell and Dakota water. (Knapp-USGS)

INVESTIGATION OF THE TECHNICAL FEASI-BILITY OF STORING FRESH WATER IN SALINE AQUIFERS, Louisiana State Univ., Baton Rouge. Water

Comar J. Esmail, and Oscar K. Kimbler.
Water Resources Res, Vol 3, No 3, pp 683-695, 1967. 13 p, 5 fig, 4 tab, 14 ref.

Descriptors: *Underground storage, *Aquifers, *Saline water intrusion, *Injection wells, *Model studies, Computer models, Hydraulic models, Porous media, Groundwater movement, Mixing, Diffusion.

Identifiers: Gravitational segregation.

Preliminary studies indicate that the underground storage of fresh water in saline aquifers may be feasible from a technical viewpoint. Such a process would involve injection of fresh water, storage until needed, and subsequent production from the same well. This work, based upon theoretical considera-tions and model studies, leads to a computer technique by means of which the recovery of stored fresh water may be estimated. Calculations involving five hypothetical aquifers indicate recoveries ranging from 25 to 85%, depending upon aquifer and fluid properties. Loss of fresh water as a result of both dispersion (mixing) and gravitational segregation was considered. Results obtained in porous flow models indicate that gravitational segregation is significantly retarded by the development of a mixed zone. Such a zone is developed naturally during injection and production as a result of fluid movement and to a lesser degree during the storage portion of the cycle as a result of W69-03336

GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,

Geological Survey, Tacoma, Wash. J. E. Luzier, J. W. Bingham, and R. J. Burt. Wash Dep Water Resources Water-Supply Bull No 36, 1968. 31 p, 14 fig.

Descriptors: *Groundwater, *Water utilization, *Irrigation, *Water level fluctuations, *Washington, Water wells, Water levels. Identifiers: Odessa (Washington), Lind (Washington)

A comprehensive study of the groundwater of the A comprehensive study of the groundwater of the Odessa-Lind area, Washington, was made by the Washington State Department of Water Resources in cooperation with the U. S. Geological Survey. The results are presented in nontechnical terms. Since about 1963, there has been a continuing increase in the use of groundwater in the Odessa-Lind area, largely for the irrigation of wheat. Although irrigated acreage comprises only a small percentage of this region of predominantly dryland farming, localized areas of water-level decline and well interference were detected as early as 1964 in narming, localized areas of water-level decline and well interference were detected as early as 1964 in a preliminary study by A. A. Garrett (Washington Department of Water Resources Water-Supply Bull. No. 31). Pumpage nearly quadrupled from 1963 to 1967, although the number of wells only doubled. This reflected a trend toward use of more doubled. This reflected a trend toward use of more powerful pumps for replacement or for installation on new wells. It became obvious that a continued increase in groundwater pumpage would accelerate the lowering of water levels and enlarge the area affected—perhaps reaching a point in a few years where the cost of pumping water from the increased depth would exceed the additional income from increased crop yield. In addition, the shallower zones of groundwater now tapped by many domestic wells would largely be drained. (Knapp-USGS) USGS)

GROUND WATER IN ONTAR SOUTHWESTERN AREA, 1960-1963.
Ontario Water Resources Commission, Toronto. **ONTARIO**

W69-03352

Ontario Water Resources Comm Ground Water Bull No 6, 1968. 485 p, 4 fig, 7 tab, 4 append.

11

Descriptors: *Data collections, *Groundwater, Water wells, Hydrologic data, Aquifers, Water levels, Water level fluctuations, Observation wells. Identifiers: *Ontario, Periodic observations, Pumping-test data, Drillers logs.

Records of wells, water level measurements, observation well hydrographs, and a discussion of the hydrology and water resources of southwestern Ontario are compiled. Each well record contains location, owner, driller, completion date, casing diameter, pumping test discharge, pumping level, static level, kind of water, use, and drillers log. Observa-tion well records include well number, observer, location, type, depth, aquifer, recording method, period of record, measuring point, and water levels. Licensed water well drillers are listed. (Knapp-W69-03354

GROUNDWATER RESOURCES OF CHOWAN COUNTY, NORTH CAROLINA, Geological Survey, Washington, D. C. O. Bruce Lloyd, Jr.

Geol Surv Hydrol Invest Atlas HA-292, 1 sheet, 1968. 5 map, 2 graph.

Descriptors: *Water resources, *Groundwater, *North Carolina, Aquifers, Water yield, Water quality, Saline water intrusion, Water wells, Municipal water, Specific capacity, Water-level fluctuations.

Identifiers: *Chowan County (North Carolina), Edenton (North Carolina), Well logs.

The results of a study of the groundwater resources of Chowan County, North Carolina are compiled in a 1-sheet Hydrological Atlas. Maps show aquifer characteristics, areas of groundwater recharge and discharge, groundwater chloride content, and piezometric contours of the aquifers. A cross section shows geologic formation and aquifer correlation from the beautiful content. tion. Graphs show annual pumpage from municipal wells and water levels in an observation well. Average specific capacities of wells are tabulated. Sediments ranging in age from Cretaceous to post-Miocene are about 2000 ft thick in the area and include 5 major aquifers composed of permeable clude 5 major aquifers composed of permeable sand, shell, and limestone beds, separated by silt and clay aquitards. Aquifer E is 320 ft deep, 100 ft thick, and it yields only 1-5 gpm to wells. Aquifer D is 220 ft deep, 50 ft thick, and wells in it have specific capacities of about 5 gpm per ft of drawdown. Aquifer C is about 150 ft deep, 40 ft thick, and wells in it have specific capacities of about 10 gpm per ft. Aquifer B is about 30 ft deep, 50 ft thick and yields a little hard water to wells. Aquifer A is surficial about 25 ft thick, and yields a little A is surficial, about 25 ft thick, and yields a little water to wells. A large cone of depression in aquifer C is caused by pumping in Edenton's well field, and its expansion is expected to increase saline water intrusion into the aquifer. (Knapptisce) W69-03355

ELECTRIC ANALOG OF THREE-DIMEN-SIONAL FLOW TO WELLS AND ITS APPLICA-TION TO UNCONFINED AQUIFERS, Geological Survey, Washington, D. C. For primary bibliographic entry see Field 07C. For abstract, see . W69-03356

ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC

FRACTURING,
Oak Ridge National Lab., Oak Ridge, Tenn. Health
Physics Div. For primary bibliographic entry see Field 08E. For abstract, see .

W69-03522

Alfred Kepinski.

CLASSIFICATION OF WATER-BEARING STRATA BASED ON CONDITIONS OF FLOW OF WATER INTO WELLS,

Field 02—WATER CYCLE

Group 2F-Groundwater

Felsmechanik und Ingenieurgeol, J Int Soc Rock Mech, Vol 6, No 3, pp 133-138, 1968. 6 p, 2 tab, 6

Descriptors: *Water wells, *Aquifers, *Specific capacity, Discharge (Water), Aquifer characteristics, Drawdown, Groundwater. Identifiers: Well capacity index, Pumping tests.

Sand and gravel aquifers are classified by a well capacity index defined as the discharge in liters per second per meter of drawdown per sq meter of well screen area. Aquifers are divided by this criterion into 7 classes. Results of testing and classifying 92 drilled wells are tabulated. (Knapp-USGS) W69-03523

AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA,

Geological Survey, Washington, D. C. Paul R. Seaber.

Prepared in cooperation with Atomic Energy Comm. Geol Surv Interim Groundwater Rep. August 1968, 75 p. 6 fig. 5 tab, 14 ref.

Descriptors: *Groundwater, *Pennsylvania, *Hydrologic data, Aquifers, Water yield, Water utilization, Water quality, Water Hydrologic properties.
Identifiers: *Susquehanna River Basin. Water sources.

The availability, quantity, quality, variability, and cost of development of the groundwater resources in the upper Susquehanna River basin in Pennsylvania are described and appraised by geological formations and by areas of the State. Water moves from the ground into most of the streams of the area with a consequently large effect on surface water quantity and quality. In most of the area, development of groundwater supplies is far below the potential maximum development. Tables show estimated specific capacities and yields, well designs, and costs of hypothetical wells in the geologic units of the area. Water chemical analyses from wells in all the geologic units are also tabu-lated. (Knapp-USGS) W69-03528

GROUND-WATER RESOURCES OF THE SEVI-ER RIVER BASIN BETWEEN YUBA DAM AND LEAMINGTON CANYON, UTAH, Geological Survey, Washington, D. C.

L. J. Bjorklund, and G. B. Robinson, Jr. Geol Surv Water-Supply Pap 1848, 79 p, 1968. 11 fig, 2 plate, 7 tab, 33 ref.

Descriptors: *River basins, Surface-Groundwater relationships, *Utah, Groundwater recharge, Groundwater movement, Water quality. Identifiers: *Yuba Dam, *Learnington Canyon, Sevier River Basin (Utah).

In order to determine the source, occurrence, availability, chemical quality, movement, recharge, discharge and use of groundwater, and the relation of groundwater to surface water within the segment of the basin between Yuba Dam and Leamington Canyon, a study of the groundwater hydrology of the Sevier River basin in Utah was made. The groundwater in Scipio Valley changes its level abruptly near midvalley caused by drainage from a shallow groundwater reservoir in the southern part of the valley. Most recharge to groundwater reservoirs occurs along the mountain fronts where streams emerge from canyons onto permeable alluvial fans. Groundwater in Little Valley is mostly in valley fill under water-table conditions at depths more than 100 ft below the land surface. Groundwater movement downstream from beneath Sevier Bridge Reservoir above Yuba Dam is not related to the discharge from Molten and Blue Springs. (L-laverias-USGS) W69-03529

HYDROGEOLOGIC DATA FOR BACA AND PROWERS COUNTIES. SOUTHERN

Geological Survey, Denver, Colo.
David B. Richards, Lloyd A. Hershey, and Richard

K. Glanzman. Colo Ground Water Basic-Data Release No 19. 1968. 123 p, 1 fig, 1 plate, 6 tab.

Descriptors: *Data collections, *Groundwater, *Colorado, *Water wells, *Water quality, Aquifers, Water levels, Water level fluctuations, Observation wells.

Identifiers: Baca county (Colo.), Prowers County (Colo.), Periodic observations.

Basic hydrologic data collected in Baca and southern Prowers Counties, Colorado, are tabulated. A map shows locations of inventoried wells. A cross section shows geologic units and their hydrologic character. Each well record shows location, owner, well depth, casing diameter, year completed, type of pump and power, altitude, depth to water, data measured, yield, and geologic source of water. Tabulated chemical analyses include well location, depth, geologic source of water, date of collection, temperature, SiO2, Fe, Ca, Mg, Na, K,HCO3, SO4, Cl, F, NO3, B, TDS, SAR, hardness, Specific conductance, and pH. Periodic water-level measurements are tabulated. Driller's logs are compiled. (Knapp-USGS) W69-03530

AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W., Sydney Univ. (Australia). Dept. of Geography.

E. D. Ongley.

J Hydrol, Vol 6, No 1, pp 15-32, Jan 1968. 18 p, 8 fig. 2 tab, 8 ref.

Descriptors: *Meanders, *Wavelengths, *Statistical methods, Bearings, Channel morphology, Hydrology.

Identifiers: *Serpentine Cave, *New South Wales, *Cavern geometry, Planimetric curves, Passage

In a preliminary study of the meandering tendency of Serpentine Cave, N.S.W., a method of wavelength determination independent of symmetry is presented. The asymmetrical winding form of Serpentine Cave in New South Wales has raised the question whether or not cavern geometry has parameters similar to those of surface meanders. Statistical treatment of passage bearings provides reasonable evidence that bearings relate to hydrology and not to structural control. Planimetnydrology and not to structural control. Planimetric curves of hydraulic significance are designated 'passage oscillations' rather than 'meanders'. Sinuosity and ratios of wavelength to channel width and of channel length to channel width are defined for Serpentine Cave. (Llaverias-USGS) W69-03532

PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN RUSSIAN),

Hydro-Chemical Inst., Novocherkassk (USSR). For primary bibliographic entry see Field 02K. For abstract, see. W69-03533

METHODS OF MEASURING WATER LEVELS

ME. HOUS OF MEASONISO
IN DEEP WELLS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B. For abstract, see . W69-03535

GROUND WATER RECHARGE, DEVELOP-MENT AND MANAGEMENT,
California Univ., Berkeley; and California State
Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 04B.
For abstract, see .
W69-03540

CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS.

International Atomic Energy Agency, Vienna

For primary bibliographic entry see Field 07B. For abstract, see .

OCCURENCE OF GROUND WATER IN THE JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA, Geological Survey, Washington, D. C. W. R. Osterkamp. Geol Surv Hydrol Invest Atlas HA-308, 1 sheet, 1968. Text, 2 map, 2 tab, 7 ref.

*Water resources, *Groundwater, Descriptors: *Aquifers, *Artesian wells, *Montana, Data collections, Hydrologic data, Water quality, Water levels, Water utilization.

Identifiers: Judith River formation (Montana), Well inventory.

A 1-sheet hydrologic atlas describes the occurrence of groundwater in the Cretaceous Judith rence of groundwater in the Cretaceous Judith River formation, north-central Montana. A geohydrologic map shows geology, geologic structure contours, locations of listed wells, potentiometric surface contours, and areas of flowing wells. Chemical analyses of 4 representative wells are listed. A list of 114 wells inventoried for the study includes location, owner, altitude, well depth, static water level, shut-in pressure of flowing wells, altitude of potentiometric surface, altitude of the top of the Judith River formation, water temperature specific conductivity, and use Geologic cross top of the Judith River formation, water temperature, specific conductivity, and use. Geologic cross sections show stratigraphic and potentiometric relations. A geologic column shows Cretaceous Montana Group stratigraphy, lithology, topography and geologic setting, and hydrology. The Judith River formation is confined above and below by shales. It yields 1 gpm per 10 ft of drawfown to wells; probably the highest yield to be expected in a 6-inch well is less than 200 gpm. Few wells flow over 10 gpm. Sodium, sulfate, bicarbonate, and total dissolved solids concentrations are high. (Ktotal dissolved solids concentrations are high. (K-napp-USGS)
W69-03545

HYDROLOGY OF SURFACE MINING-A CASE

STUDY, Indiana Univ., Bloomington. For primary bibliographic entry see Field 02A. For abstract, see .

DISPERSION AT THE INTERFACE OF MISCIBLE LIQUIDS IN A SOIL,
Syracuse Univ., N. Y.
Wen-Hsiung Li, and Gour-Tsyh Yeh.
Water Resources Res, Vol 4, No 2, pp 369-377,
Apr 1968. 9 p, 7 fig, 10 ref.

Descriptors: *Saline water-freshwater interfaces, *Dispersion, *Diffusion, *Groundwater movement, Porous media. Identifiers: Fick's law, Miscible liquids.

When 2 miscible liquids flow through a porous medium (e.g., fresh water and salt water in an aquifer), the dispersion at the interface is described by Fick's law with a velocity-dependent coefficient. The horizontal flow of 2 liquids is used to demonstrate that the influence of gravity and the effects of the differences in density and viscosity are usually negligible. Solutions are presented for the dispersion at the interface of liquids in 2-dimensional flow. flow. W69-03548

THERMAL PROSPECTING FOR GROUND WATER,

Illinois State Geological Survey, Urbana. Keros Cartwright.
Water Resources Res, Vol 4, No 2, pp 395-401, Apr 1968. 7 p, 5 fig, 10 ref.

Water in Soils—Group 2G

Descriptors: *Groundwater, *Thermal properties, *Exploration, Geophysics, Geothermal studies, Heat flow, Aquifers.
Identifiers: *Thermal prospecting.

Theoretical consideration of the thermal properties of unconsolidated deposits suggests that a shallow aquifer might form a heat sink that influences and modifies the temperature effects of heat originating at the land surface and within the crust. The unconsolidated water-yielding deposits apparently are not of the same temperature as the material surrounding them. If the shallow aquifer is nonu-niformly distributed, it should produce a temperature anomaly in the surface soil. The size of the anomaly resulting from a shallow aquifer would de-pend on the thermal properties and thickness of the overburden and on temperature differences between the surface and the aquifer. Thermal prospecting offers promise as a rapid, inexpensive, and fairly reliable means of locating shallow linear unconsolidated aquifers in glacial alluvial deposits. W69-03549

A DERIVATION OF DUPUIT SOLUTION OF STEADY FLOW TOWARD WELLS BY MATCHED ASYMPTOTIC EXPANSIONS,

Technion - Israel Inst. of Tech., Haifa.

Water Resources Res, Vol 4, No 2, pp 403-412, Apr 1968. 10 p, 3 fig, 12 ref.

Descriptors: *Groundwater movement, *Steady flow, *Mathematical models, Dupuit-Forchheimer theory, Porous media, Wells. Identifiers: Asymptotic expansions.

An approximate solution of the steady and shallow free-surface flow toward a well in a layer of infinite extent is obtained by expanding the velocity potenextent is obtained by expanding the velocity poten-tial in a small parameter power series. This expan-sion is shown to be valid only in the vicinity of the well and is, therefore, called the inner expansion. An outer expansion, which solves the flow problem at large distance from the well, is derived by using the method of matched asymptotic expansions. The Dupuit approximation coincides with the zero order term of the potential outer expansion. The order term of the potential outer expansion. The derivation of a second order outer term makes possible the discussion of the validity of the Dupuit approximation, which tends asymptotically toward the exact solution. In the outer zone, the streamlines are parabolic and are not orthogonal to the equipotentials. The method is illustrated by 2 numerical examples. W69-03550

THE INVESTIGATION OF WATER FLOW THROUGH POROUS MEDIUMS BY MEANS OF RADIOTRACERS,

Australian Atomic Energy Commission Research Establishment, Lucas Heights; and Bureau of Mineral Resources, Geology, and Geophysics, Can-

W. R. Ellis, L. Kevi, and W. A. Wiebenga.
Water Resources Res, Vol 4, No 2, pp 413-416,
Apr 1968. 4 p, 2 fig, 1 tab, 6 ref.

Descriptors: *Groundwater movement, *Dispersion, *Tracers, Hydraulic models, Porosity, Porous media, Sands, Dupuit-Forchheimer theory. Identifiers: Bromine radioisotopes.

The radioisotope bromine 82 was used to measure the flow of water through a packed sand column. It was shown that the commonly accepted Dupuit-Forchheimer assumption did not apply under these conditions. Some information was also obtained on lateral dispersion using iron gauzes and copper 64 solution. W69-03551

THE PERMEABILITY OF A POROUS MEDIUM DETERMINED FROM CERTAIN PROBABILITY LAWS FOR PORE SIZE DISTRIBUTION, Cornell Univ., Ithaca, N. Y. School of Civil En-

gineering. Wilfried Brutsaert.

Water Resources Res, Vol 4, No 2, pp 425-434, Apr 1968. 10 p, 3 fig, 20 ref.

Descriptors: Descriptors: *Permeability, *Porous media, *Mathematical models, Soil moisture movement, Hydraulic models, Porosity, Dupuit-Forchhemier

Identifiers: Series-parallel porosity model, Soil moisture-suction relationship, Porosity-permeability relationships.

An equation derived for the permeability of a porous medium based on the general principles of the series-parallel model contains a double integral which is solved for several continuous probability laws describing the distribution of the sizes of the interstices of the porous medium. The agreement between calculated results and available experimental data is satisfactory. W69-03553

SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS.

Utah State Univ., Logan.
For primary bibliographic entry see Field 02G. For abstract, see . W69-03554

SODIUM AS A CLUE TO DIRECTION OF GROUNDWATER MOVEMENT, NEVADA TEST

Geological Survey, Washington, D. C., and Geological Survey, Denver, Colo.
Stuart L. Schoff, and John E. Moore.
Geol Surv Res 1968, Prof Pap 600-D, pp D30-33,

1968. 4 p, 2 fig, 5 ref.

Descriptors: *Groundwater movement, *Water quality, *Tracers, Groundwater basins, Sodium, Nevada.

Identifiers: Natural tracers, Interbasin groundwater flow, Nevada Test Site.

Groundwater movement at the Nevada Test Site was traced by study of the sodium content of waters in the area. The source of the sodium at the Nevada Test Site is in Tertiary volcanic rocks. Sodium dissolved in water generally stays in solution. It is the predominant cation in groundwater in volcanic aquifers in the Nevada Test Site, but is nearly lacking in alluvial and carbonate-rock aquifers in southern Indian Spring valley south of the Nevada Test Site. The low content of sodium in the water of Indian Spring valley shows that the water has not migrated into the valley from the Nevada Test Site. (USGS) W69-03559

FLOOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON, MISSISSIP-

Geological Survey, Jackson, Miss. K. V. Wilson.

Geol Surv Res 1968, Prof Pap 600-D, pp D57-D59, 1968. 3 p, 2 fig, 1 ref.

Descriptors: *Streamflow, *Channel improvement, *Floodwater, *Mannings Equation, *Discharge coefficients, Roughness (Hydraulic), Velocity, Hydraulic radius, Stream gages, Vegetation effects. Identifiers: Jackson (Miss.), Flood profiles.

Extreme changes in velocity, stage, and Manning's roughness coefficient n were observed during the first year after construction of an earthen canal for Hanging Moss Creek at Jackson, Miss. The channel, constructed during the summer of 1963, had a 30-ft-wide bottom, 2:1 side slopes, and 12-ft depth. On March 2, 1964, velocities of 7.8 ft per second were observed at a 5 1/2-ft depth in the clean chanwere observed at a 5 1/2-11 depth in the clean chairmanel and Manning's n was computed to be 0.025. By October 1964, velocities of 3.2 ft per second existed at a 5 1/2-ft depth and Manning's n was computed to be 0.05 in channel which was then lined with fairly thick vegetation consisting of small willows, weeds, and grasses. The observations indicate that the values of Manning's n commonly used in

channel rectification are low, and that the carrying capacity of earthen channels may be reduced 100% as a result of only 1 year's growth of vegetation. W69-03566

TEMPERATURE VARIATIONS OF DEEP FLOWING WELLS IN SOUTH DAKOTA, Geological Survey, Rapid City, S. Dak.; and Geological Survey, Huron, S. Dak. D. G. Adolphson, and E. F. LeRoux. Geol Surv Res 1968, Prof Pap 600-D, pp D60-D62, 1968 3 n 4 fg 1 tab. A fg 6

1968. 3 p, 4 fig, 1 tab, 4 ref.

Descriptors: *Artesian wells, *Water temperature, *South Dakota, Depth, Discharge (Water), Geothermal studies, Aquifers.

Identifiers: Geothermal gradient, Dakota sand-

Measurements from about 200 deep artesian wells in South Dakota indicate that temperature dif-ferences in water flowing from wells of similar con-struction are related to the depth of wells and volume of discharge. Geothermal gradients at wells in the Dakota Sandstone east of the Missouri River range from 0.7 deg C per 100 ft in the southeast and 1.1 deg C per 100 ft in the northeast to 1.6 deg C per 100 ft along the Missouri River. Immediately west of the river, geothermal gradients average 1.5 deg C per 100 ft. In a 'hot water belt' farther west, average geothermal gradients of 2.2 deg C per 100 the Dakota Sandstone. Relatively low geothermal gradients in pre-Cretaceous rocks in the Black Hills may be due, in part, to rapid downward movement of recharging water in very porous formations. W69-03567

THERMAL SPRINGS NEAR MIDWAY, UTAH, Geological Survey, Salt Lake City, Utah. C. H. Baker, Jr.

Geol Surv Res 1968, Prof Pap 600-D, pp D63-D70, 1968. 8 p, 7 fig, 1 tab, 6 ref.

Descriptors: *Thermal springs, *Water quality, *Thermal water, *Utah, Calcium, Carbonates, Discharge (Water), Recharge. Identifiers: Calcareous tufa, Geothermal gradient,

Midway (Utah).

A group of thermal springs near Midway, Utah, is surrounded by a deposit of calcareous tufa that covers an area of about 4.5 sq mi and locally is at least 70 ft thick. The springs include both flowing thermal springs and hot pots, which are small pools thermal springs and not pots, which are small poors of warm water occupying shallow craters in the tops of conical or hemispherical mounds of tufa. Extinct hot pots (dry craters) and solid mounds of tufa as much as 10 ft high are also common. The water from the flowing springs and hot pots is not highly mineralized (the total dissolved solids rarely highly mineralized (the total dissolved solids rarely exceeds 2,000 mg/1), but it is saturated with respect to calcium carbonate. The spring water is of meteoric origin; it enters the carbonate bedrock in the nearby Wasatch Range and moves rapidly through fractures and solution openings. The geothermal gradient in the vicinity of Midway is abnormally high, but the reasons for the high heat flux are not known. (USGS) W69-03568

2G. Water in Soils

THE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,

Manchester Univ. (England); and Salford Univ.

For primary bibliographic entry see Field 02A. For abstract, see W69-03205

SUBSIDENCE INFILTRATION PROCESSES IN LOESS SOILS, Azerbaijan Polytechnic Inst., Baku (USSR).

Field 02-WATER CYCLE

Group 2G-Water in Soils

A. A. Mustafaev.

A.A. Mustalack. Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 155-158, 1967. 4 p, 5 fig, 2 tab, 9 ref.

Descriptors: *Seepage, *Open channels, *Loess, Infiltration, Subsidence, Mathematical models, Onsite tests, Soil moisture. Identifiers: *USSR, Azerbaijan.

Field experiments were made of infiltration and associated subsidence problems in typical loess soils in Azerbaijan. The relations between water depth, nn Azerbaijan. The relations between water depth, trench geometry, soil characteristics, time, and subsidence are given graphically and in derived equations. (Knapp-USGS)
W69-03207

ON THE MECHANISM OF SUSPENDED CAPIL-LARY WATER AND PERCHED GROUND-WATER,

Akademiya Nauk Armyanskoi SSR, Erevan. Institut Geologicheskikh Nauk.

For primary bibliographic entry see Field 02F. For abstract, see . W69-03208

STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL, Water Planning for Israel Ltd., Haifa.

Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 165-167, 1967. 3 p, 11 fig, 5 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Soil profiles, *Anisotropy, *Digital computers, Numerical analysis, Computer programs.

Identifiers: Vertical flow, Multilayered soil, Runge-Kutta-Gill numerical integration.

Steady unsaturated vertical flow through multilayered soil was solved numerically with the aid of a digital computer. An initial-value formulation is used, and the scheme is based on the RKG integration method in conjunction with the bisection rou-tine. Examples with 2 to 5 layers were worked out. The results are presented graphically. (Knapp-W69-03209

INVESTIGATION OF WATER ABSORPTION BY THE SOIL ON THE BASIS OF THE DIMENSIONAL THEORY, V. Ya. Kulik.

V. 1a. Kulik. Transl from Trudy Gos Gidrol Inst, No 146, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 370-393, 1967. 24 p, 2 fig, 27 ref.

Descriptors: *Infiltration, *Porous media, *Dimensional analysis, *Wetting, Permeability, Soil texture, Soil types. Identifiers: Wetting curve.

The dynamics of water infiltration into homogeneous soils is analyzed with allowance for the shape of the wetting front, which was frequently observed to be wedge-shaped. It is shown that strict use of dimensional analysis makes it possible to obtain relationships that describe the process and agree well with experiment. The physical significance of capillary columns is examined and it is demonstrated that the mathematical apparatus of this theory is not at variance with the phenomenon of a wedge-shaped wetting front. The shapes of wetting fronts of porous media with various physical properties are analyzed. (Knapp-USGS) ous soils is analyzed with allowance for the shape of

SOIL MOISTURE.

National Research Council of Canada, Ottawa (Ontario). Subcommittee on Hydrology.

Proc Hydrol Symp No 6, Nat Res Counc Can, Nov 1967. Total 336 p, 58 fig, 17 tab, 413 ref, 1 append.

Descriptors: *Soil moisture, *Soil water move-ment, *Surface-groundwater relationships, *Un-saturated flow, Evapotranspiration, Groundwater movement, Infiltration, Percolation, Permeability, Recharge, Instrumentation, Analog models, Digital computers, Thermodynamics, Freezing, Thawing. Identifiers: *Symposia, University of Saskatchewan.

A symposium on soil moisture, particularly on movement of soil water, was held at the University of Saskatchewan, November 1967. The 11 papers presented treat soil moisture as part of the hydrologic cycle, relating it to atmospheric water, surface water, and groundwater. The subjects of the papers are moisture in the hydrologic cycle, thermodynamics of soil moisture, movement of moisture and chemical substances, evaluation of flow parameters, similitude for partially saturated flow systems, electrical analog and digital com-puter estimation of unsaturated flow, effect of soil moisture on infiltration, soil moisture and evapotranspiration, continuity of groundwater flow and unsaturated flow, freezing and thawing, and instrumentation. (Knapp-USGS) W69-03223

CLIMATE AND SOIL MOISTURE EXTRAC-

TION, Volcani Inst. of Agricultural Research, Bet-Dagan (Israel); and Israel Meteorological Service, Bet-

(Israel); and Israel Meta-Scale Dagan.
Dagan.
Cobadiah P. Cohen.
Coop Invest by US Weather Bur (ESSA) and Volcani Inst of Agr Res and Israel Meteorol Serv. Environ Sci Serv Admin Rep, 1967. 216 p, 14 fig, 2 tab, 8 ref 4 append. CWB 10836.

Descriptors: *Data collections, *Soil moisture, *Meteorological data, *Microclimatology, Soilwater-plant relationships, Soil temperature, Evapotranspiration, Solar radiation, Air temperature, Wind velocity, Humidity. Identifiers: *Israel.

A study relating soil moisture to climatological conditions was made at the Gilat Experiment Station of the Volcani Institute of Agricultural Research, Israel, between Oct 20, 1965 and July 31, 1967, to collect a long-term comprehensive record to be made available to scientists who need such records. Punched card decks of the data com-piled in the report are available by written request to Director, National Weather Records Center, Federal Building, Asheville, North Carolina, USA. The data compiled are soil moisture, radiation, wind, soil temperature, air temperature, humidity, and general meteorological station data. A detailed description of each deck of punched cards is given. The data collection methods are discussed thoroughly. Evapotranspiration calculations were improved by plot treatment to prevent deep drainage. (Knapp-USGS)
W69-03250

DETERMINATION OF THE HYDRAULIC CON-DUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA, Grenoble Univ., (France). Laboratoires de Mecanique des Fluides. Georges Vachaud. Water Resources Res, Vol 3, No 3, pp 697-705, 1967. 9 p, 9 fig, 2 tab, 14 ref.

Descriptors: *Hydraulic conductivity, *Unsteady flow, *Infiltration, *Soil water movement, *Unsaturated flow, *Darcys law, Infiltrometers, Capillary conductivity, Permeability, Model studies. Identifiers: *Unsaturated soils, Transient flow.

A method is suggested for checking the validity of the generalized Darcy's law for water infiltration into soil and for computing values of the hydraulic conductivity at various water contents in unsatu-rated flow. Water profiles obtained by gamma-ray absorption during infiltration into soil columns and the wetting part of the soil-water content relation

were analyzed. Both horizontal infiltration and were analyzed. Both horizontal infiltration and capillary rise experiments were performed. For a given water content, capillary conductivity was constant and the generalized Darcy's law was valid for use to describe transient flow in unsaturated soils. (Knapp-USGS) W69-03337

VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES, Southeastern Forest Experiment Station, Franklin,

N. C. J. E. Douglass.

Reprint from Soil Sci. Soc. of Amer. Proc. 31 (5):541-544, 1966.

Descriptors: *Nuclear moisture meter, *Soil water movement, *Infiltration, *Forest soils, Instrumen-tation, Moisture meters, Soil moisture meters, Soil Identifiers: *Neutron meters.

A volumetric method of estimating the slope (b coefficient) of a neutron moisture probe calibration curve is discussed. Coefficients obtained for three probes by this method did not differ signifithree proces by this method did not differ significantly between soil series or between horizons within a series. Simply dividing the count rate in water by 100 gave a value virtually identical to the b coefficient determined volumetrically for these b coefficient determined volumetrically for these probes and soils. Agreement was excellent between measured outflow and outflow predicted from neutron measurements made with a volumetrically calibrated moisture probe. W69-03394

EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY, F. E. Robinson, D. W. Cudney, and J. P. Jones. Calif Agr, Vol 22, No 12, pp 10-11, Dec 1968. 2 p,

Descriptors: *Soil amendments, *Agricultural chemicals, California, Arid lands, *Irrigation water, On site tests, *Flow measurement, *Infiltra-

Identifiers: *Imperial Valley (Calif), Soil intake rates.

Tests were conducted at the Imperial Valley Field Station to determine whether addition of soil amendments would increase soil intake rates. These tests were conducted with three compounds commonly used by growers in the area as soil amendments: calcium polysulfide, ammonium polysulfide, and sulfuric acid. Of the various chemipolysulfide, and sulfuric acid. Of the various chemicals tested, only ammonium polysulfide produced a significant increase in soil intake rates. Failure of calcium polysulfide to produce a similar increase proved that this effect was not associated with the polysulfide compound. The increase in soil intake rates associated with the aqueous application of ammonium polysulfide was evidently caused by a unique property of this compound which is not yet understood. (Affleck-Ariz) W69-03481

EFFECT OF ORGANIC MATTER CONTENT OF

THE SOIL ON INFILTRATION,
Agricultural Research Service, Lafayette, Ind.
W. H. Wischmeier, and J. V. Mannering.
J Soil Water Conserv, Vol 20, No 4, pp 150-152,
July-Aug 1965. 3 p, 1 fig, 1 tab.

Descriptors: *Organic matter, *Infiltration, *Crop production, Simulated rainfall, *Runoff, Arid lands, Contour farming, Aggregates, *Soil proper-Identifiers: Plots.

The soil and its organic matter content was discussed with respect to infiltration as it is related to plant residues, contour farming and the effects which soils properties have on infiltration. The favorable effect of increasing quantitites of organic residues in soil was shown by the increases in infil-

tration following changes in crop productivity and residue management. For 82 plot-years of continuous corn crops with residue removed, runoff from the 60 days after seeding averaged 83% of the cor-responding runoff from fallow. Plots with high corn yields and correspondingly large quantities of residue material had substantially less runoff than plots with lower yields. Where relatively small quantities of residue were incorporated, contour farming reduced runoff 13-23%. When simulated rainstorms were applied to a wide range of soil types, the organic matter content of the soil was the measured variable most closely correlated with ru-noff. The organic matter content of arid soils is closely related to infiltration and runoff. (Blecker-Ariz) W69-03484

SAMPLING THE SOIL SOLUTION FOR SALINITY APPRAISAL, Agricultural Research Service, Riverside, Calif.

Salinity Lab. R. C. Reeve, and E. J. Doering.

Soil Science, Vol 99, No 5, pp 339-344, May-1965. 6 p, 3 fig, 2 tab.

Descriptors: *Sampling, *Soil analysis, Chemical analysis, Salinity, *Water analysis, *Saline soils, Soil chemistry, *Instrumentation, Leaching, Electrical conductance, Analytical techniques, Depth. Identifiers: Soil depth, Soil solution.

The paper describes procedures and equipment that have been found useful in sampling soil solution by the suction method both in the field and in laboratory soil columns. In the field, the procedure has been used to follow changes in composition of the soil solution with soil depth and time during reclamation of sodic soils and to assess salinity status of the root zone of crops under irrigation. In the laboratory, it has been used to determine changes in soil solution composition in soil columns during leaching and cropping. Reliable and consistent values for soil solution composition were obtained by the suction method in the soil suction range of 0-500 millibars. Since most water movement in soil occurs in this suction range, the method may be used in many areas dealing with soil salinity. (Blecker-Ariz)
W69-03488

MEASURING MOISTURE NEAR SOIL SUR-FACE...MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
Pacific Southwest Forest and Range Experiment

Station, Berkeley, Calif.; and California State Dept. of Water Resources, Sacramento; and California State Dept. of Water Resources, Bakersfield. Robert Ziemer, Irving Goldberg, and Norman A.

MacGillivray. US Forest Service Research Note PSW 158, 1967.

6 p, 1 fig, 4 tab.

Descriptors: *Arid climates, *Nuclear moisture meters, *Soil surfaces, *Moisture content, Moisture meters, Measurement, Instrumentation, Soil moisture.

Identifiers: Vertical resolution.

Usefulness of the neutron meter is limited if it is necessary to measure moisture near the soil surface. Moisture measurements were made in three face. Moisture measurements were made in three media: paraffin, water and saturated sand-with four neutron moisture meters. The neutron source was 226-radium-beryllium, 227-actinium-beryllium, 239-plutonium-beryllium or 241-americium-beryllium. The surface of the medium was detected at a fairly consistent depth with each source in a particular medium. Variability in surface detection by the different source may be due to differences in neutron sources, in the length source or both. The neutron soil moisture meter is useful in measuring the soil moisture depletion in arid soils. (Bleckerthe soil moisture depletion in arid soils. (Blecker-Ariz) W69-03498

ACCURACY OF SOIL MOISTURE READINGS WITH UNSEALED ACCESS TUBES, Forest Service, Fort Collins, Colo.

Arnett C. Mace, Jr.

U S Forest Service Research Note RM-61, May, 1966. 2 p. 1 tab.

Descriptors: Soil moisture, *Nuclear moisture meters, Moisture meters, *Moisture content, Soil water movement, *Water table, Tubes, *Zone of saturation, Soil moisture meters, Water wells, Measurement, Condensation. Identifiers: Access tubes.

Objectives of the study were to determine whether accurate soil moisture measurements could be made if access tubes were not sealed on the bottom and also whether these tubes could be utilized as a water table well where desired. Measurements taken above the zone of saturation were accurate since presence of condensation inside the unsealed access tube had a negligible influence on measurements. In studies with water tables near the surface, it would be desirable to use sealed tubes because entry of water could prevent accurate following of moisutre-depletion rates by neutron readings and might cause short-circuiting and corrosion of the probe. The soil moisture of arid soils can be measured with the techniques used in the study. (Blecker-Ariz) W69-03500

THE EFFECTS OF ENTRAPPED AIR AND BAROMETRIC FLUCTUATIONS ON THE DRAINAGE OF PUROUS MEDIUMS,

Saskatchewan Univ., Saskatoon; and California

D. I. Norum, and J. N. Luthin.

Water Resources Res, Vol 4, No 2, pp 417-424, Apr 1968. 8 p, 4 fig, 12 ref.

Descriptors: *Drainage, *Soil water movement, *Air entrainment, Unsaturated flow, Diffusion, Identifiers: Entrapped air.

A theory was developed for transient drainage of porous mediums taking into consideration the air that is entrapped within the flow region. The theory is based on the soil moisture diffusion equation with modifications made to include the effect of the entrapped air and the effect of changes in pressure due to barometric fluctuations. The theory was tested on a 1-dimensional flow sand model, and the results were compared with results obtained from a numerical solution of the developed equation. The theory and experiments show that barometric fluctuations have little effect on a draining column containing entrapped air when the column is open to the atmosphere at both ends. However, when the column is closed at the bottom, an increase in atmospheric pressure lowers the position of the water table, whereas a decrease in atmospheric pressure raises the water table. Both the experiments and the developed theory show a much greater change in the position of the water table with atmospheric pressure than a previous steady-state theory. W69-03552

THE PERMEABILITY OF A POROUS MEDIUM DETERMINED FROM CERTAIN PROBABILITY LAWS FOR PORE SIZE DISTRIBUTION, Cornell Univ., Ithaca, N. Y. School of Civil En-

For primary bibliographic entry see Field 02F. For abstract, see . W69-03553

SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS, Utah State Univ., Logan.

Roland W. Jeppson.
Water Resources Res, Vol 4, No 2, pp 435-445, Apr 1968. 11 p, 7 fig, 5 ref.

Descriptors: *Seepage, *Channels, *Porous media, *Anisotropy, Mathematical models, Groundwater movement, Soil water movement, Surface-groundwater relationships, Approximation method, Digital computers.
Identifiers: Finite difference methods, Layered

porous mediums.

Solutions to steady-state free surface problems of seepage from channels through porous mediums consisting of layers of different permeabilities are obtained by using the methods of finite differences. In the formulation of the problem, the magnitudes of the coordinates x and y are considered the dependent variables, and the potential function and the stream function are considered the independent variables. The method permits the shape of dent variables. The method permits the snape of the interface that separates the two layers with dif-ferent permeabilities to be specified. In the event that each layer is anisotropic, but with different ratios of horizontal to vertical permeabilities, the interface between the two layers is restricted to being horizontal. Example solutions are given for arbitrarily specified interfaces for both the case of seepage from a trapezoidal channel through homogeneous isotropic mediums in each layer (but of different permeabilities) and the case of anisotropic mediums in which the ratio of horizontal to vertical permeabilities is different for each layer. W69-03554

MOVEMENT OF MOISTURE IN THE UNSATURATED ZONE IN A DUNE AREA, SOUTHWESTERN KANSAS,

Geological Survey, Garden City, Kans.

Robert C. Prill.

Geol Surv Res 1968, Prof Pap 600-D, pp D1-D9, 1968. 9 p, 5 fig, 2 tab, 4 ref.

Descriptors: *Infiltration, *Recharge, *Unsaturated flow, *Dunes, Kansas, Percolation, Evapotranspiration, Evaporation, Grasses. Identifiers: Arkansas River.

Moisture-content logs for the predominant vegetative conditions in the sanddune area of southwestern Kansas depict the manner of southwestern Kansas depict the manner of moisture buildup and depletion, and illustrate conditions necessary for deep percolation. Even though the period of study included a year when precipitation was nearly the highest on record, built-up moisture under a sagebrush-grass community penetrated to a depth of only 14 ft, whereas the zone of evapotranspiration extended to at least 17 ft. Under a grass community where the zone of evapotranspiration extended to about 11 ft, a small amount of moisture (2 in.) moved as deep percola-tion. Under a barren area, where most of the loss by evaporation occurred in the upper 1 ft, large quan-tities of moisture moved as deep percolation. W69-03556

2H. Lakes

COMPUTATION OF SEICHE VELOCITIES IN BODIES OF WATER WITH A COMPLEX BOTTOM RELIEF,

N. D. Shtefan.

Transl from Meteorol i Gidrol, No 7, 1967, pp 78-82. Soviet Hydrol: Selec Pap, Issue No 4, pp 394-397, 1967. 4 p, 3 fig, 2 ref.

Descriptors: *Seiches, *Lakes, *Water circulation, Waves (Water), Mathematical studies, Model studies, Velocity, Lake stages. Identifiers: Lake Baikal, Lake bottom relief.

An approximate method for computing seiche velocities in bodies of water with complex plan and velocities in bodies of water with complex plan and bottom relief is given. The position of the node, the shape of the body, and the free surface profile must be known to compute average half-period and maximum surface velocities at any point on the water body's axis. Seiches of Lake Baikal were simulated in a model scaled 1:100,000 with a vertical distor-

Field 02-WATER CYCLE

Group 2H-Lakes

tion of 20:1. Agreement with field observations was within 10s15%. (Knapp-USGS) W69-03217

LAKE GIBSON LAND CO V LESTER (IRRIGA TION BY PUMPING LOWERING LAKE LEVEL)

102 So 2d 833-836 (2d DCA Fla 1958).

Descriptors: *Florida, *Reasonable use, *Water rights, Judicial decisions, Public rights, Relative rights, Riparian rights, Irrigation, Irrigation effects, Lakes, *Pumping, Usufructuary right.

Plaintiff, owner of lakeshore property, sought an injunction to prevent defendant from pumping water out of the lake for irrigation purposes during any period when the water of the lake was below its normal level. Evidence showed that the pumping lowered the level of the lake less than one inch. While the court recognized that the plaintiff had been injured by the lowered level of the lake, it could find no evidence that the defendant's irrigation pumping was responsible for the damage. While an injunction would have been granted if the defendant had made unreasonable use of the lake waters, the court held that this requirement had not been met, and the injunction was denied. (Scott-W69-03285

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES: II. CURRENT METER STUDIES OFF SHEBOYGAN, WISCONSIN, AUGUST 1967,

Michigan Univ., Ann Arbor. Great Lakes Research

Vincent E. Noble. Spec Rep No 37, Great Lakes Res Div, pp 12-25, 1968. 14 p, 7 fig, 2 ref. Grant WP-01067 (FWP-

Descriptors: *Currents (Water), *Circulation, *Lake Michigan, Winds, Density currents, Current meters, Buoys, Lake morphology.

Identifiers: Lake circulation Geostrophic circulation, Ekman transport.

Current meter measurements in Lake Michigan off Sheboygan give results that conflict seriously with computations from drogue data, wind velocity data, and dynamic water surface height data, and are notably divergent for meter stations only 1/2 mile apart. The results of computation of currents from these data are shown by charts. The complex relation between current vectors and the wind field may be explained by Ekman transport and ac-celeration of geostrophic eddies. No explanation is given for other discrepancies. (Knapp-USGS) W69-03334

INTRODUCTION TO PALEOLIMNOLOGY,
Texas Technological Coll., Lubbock. Dept. of

For primary bibliographic entry see Field 02J. For abstract, see . W69-03342

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES: 1. CHARACTERIZATION OF THE CIRCULATION DYNAMICS OF LAKE MICHIGAN, Michigan Univ., Ann Arbor. Great Lakes Research

Vincent E. Noble.

Spec Rep No 37, Great Lakes Res Div, pp 4-11, 1968. 8 p, 5 fig, 4 ref. Grant WP-01067 (FWPCA).

Descriptors: *Currents (Water), *Circulation, *Lake Michigan, Density currents, Winds, Temperature, Air-water interfaces, Isotherms, Radiation, Lake basins.

Identifiers: Lake circulation dynamics. Geostrophic circulation.

Surface temperature patterns of Lake Michigan obtained by synoptic observations from aircraft and interpreted with the aid of dynamic water surface height computations imply that geostrophic circulation forces are dominant over wind circulation forces. The interaction between forces in the lake's circulation is complex and presently unknown. The persistence of small details in the surface temperapersistence of small details in the surface tempera-ture structure of the lake for periods of 3 weeks supports the idea of dominance of geostrophic forces. Isotherms of surface temperatures of the lake are shown on a map. (Knapp-USGS) W69-03347

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES: III. DETERMINATION OF EDDY VISCOSITY AND EDDY DIFFUSIVITY IN LAKE MICHIGAN,

Michigan Univ., Ann Arbor. Great Lakes Research

Joseph C. Huang. Spec Rep No 37, Great Lakes Res Div, pp 26-45, 1968. 20 p, 6 fig, 6 tab, 22 ref. Grant WP-01067 (FWPCA).

Descriptors: *Currents (Water), *Circulation, *Lake Michigan, Winds, Eddies, Turbulence, Tracers, Dye releases.
Identifiers: Eddy viscosity, Eddy diffusivity, Verti-

cal eddy diffusivity.

To evaluate the magnitude of the eddy diffusivity and eddy viscosity associated with the thermal current structure of the late spring/early summer circulation in the Lake Michigan model, current meters, drogues, wind gages, and dye diffusion tests were used to collect data. In modelling a geofluid problem, the eddy viscosity and the eddy diffusivity are of critical importance in order to predict the natural current or wave phenomena with a similarity to laminar flow. In Lake Michigan, though the mean current velocity is small in general, the flow field is turbulent in nature. In solving or explaining the flow pattern of the mean lake current, it is possible to use the governing equations of laminar flow with eddy viscosity and eddy diffusivity in place of the molecular viscosity and the molecular diffusivity. The data presented are quite consistent diffusivity. The data presented are quite consistent and in good agreement with the data reported by other investigators. The vertical eddy viscosity in Lake Michigan is in the range of 1 to 100 with a mean of 10 sq cm/sec. The horizontal viscosity is in the range of 100 to 10,000 with a mean value of 1,000 sq cm/sec. The eddy diffusivity may reach the same magnitude as the viscosity but it is in general smaller. A typical mean value for vertical eddy diffusivity is 5 sq cm/sec and for the horizontal eddy diffusivity, 100 sq cm/sec. (Knapp-USGS) W69-03348

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES: IV. NUMERICAL EVALUATION OF STERN'S CALCULATION MODEL, Michigan Univ., Ann Arbor, Great Lakes Research

James H. Saylor. Spec Rep No 37, Great Lakes Res Div, pp 46-58, 1968. 12 p, 2 fig, 4 tab, 4 ref. Grant WP-01067 (FWPCA).

Descriptors: *Currents (Water), *Circulation, *Lake Michigan, *Mathematical models, Winds, Eddies, Turbulence, Vortices. Identifiers: Ekman drift, Geostrophic vortex.

mathematical model for the interaction of a uniform wind stress and a geostrophic vortex is evaluated in terms of wind stresses and vortex evaluated in terms of wind stresses and vortex dimensions that are expected to occur in Lake Michigan. The results predict a broad range of internal wave periods that are within the limits of measured values. The model provides mechanisms for some field observations of rotary currents, internal waves, and transfer of wind energy into water circulation in a way that might explain some apparently anomalous drogue and current meter data in the Lake Michigan study. (Knapp-USGS) W69-03349 VERTICAL CURRENT STRUCTURE IN THE STRUCTURE IN LAKE MICHIGAN, AS-SOCIATED WITH THE SPRING WARM-UP SEASON-A THEORETICAL STUDY, Michigan Univ., Ann Arbor. Great Lakes Research

Joseph C. Huang. Spec Rep No 37, Great Lakes Res Div, pp 59-94, 1968. 36 p, 11 fig, 2 tab, 11 ref. Grant WP-01067 (FWPCA).

Descriptors: *Currents (Water), *Circulation, *Temperature, *Lake Michigan, *Mathematical models, Winds, Eddies, Thermal properties, Coriolis force.

Identifiers: Geostrophic circulation, Thermal

A mathematical model treats Lake Michigan as a A mathematical model treats Lake Michigan as a long, symmetrical, trapezoidal body with 2 oppositely imposed horizontal temperature gradients toward the center from both sides, rotating about its vertical axis, with a free surface, without wind stresses. The main flow field is assumed to be in geostrophic thermal gradient equilibrium. The solution of the temperature distribution of the model shows about the same pattern as the lake, prescribility in the interior region Circulation patages. especially in the interior region. Circulation pat-terns in the lake and model agree well in general, and the model shows that geostrophic circulation is dominant over wind circulation, which explains some currents observed to be counter to wind direction. The lake's current and temperature structures are shown on maps and charts. (Knapp-USGS) W69-03350

MICROSESTON DYNAMICS IN A SIMPLE

SIERRA NEVADA LAKE-STREAM SYSTEM, Bureau of Sport Fisheries and Wildlife, Bishop, Calif., and California Univ., Davis. Dept. of Zoolo-

For primary bibliographic entry see Field 02E. For abstract, see W69-03359

PALEOECOLOGICAL STUDIES OF POTATO LAKE AND ITS ENVIRONS,

Indiana Univ., Bloomington. For primary bibliographic entry see Field 02J. For abstract, see . W69-03361

PHOSPHORUS RELEASE FROM BOG LAKE

Wisconsin Univ., Madison. Dept. of Soil Science; and Wisconsin Univ., Madison. Dept. of Zoology. For primary bibliographic entry see Field 02K. For abstract, see . W69-03363

RECENT SEDIMENTS OF THREE WISCONSIN

Shell Oil Co., Houston, Tex. For primary bibliographic entry see Field 02J. For abstract, see . W69-03367

ACETYLENE REDUCTION BY NITROGEN-

FIXING BLUE-GREEN ALGAE,
Wisconsin Univ., Madison. Dept. of Biochemistry;
and Wisconsin Univ., Madison. Water Chemistry Lah

For primary bibliographic entry see Field 02K. For abstract, see . W69-03368

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION

USING THE ACETYLENE REDUCTION
TECHNIQUE,
Wisconsin Univ., Madison. Dept. of Biochemistry;
and Wisconsin Univ., Madison. Water Chemistry

For primary bibliographic entry see Field 02K. For abstract, see . W69-03372

2I. Water in Plants

INTERCEPTION BY EASTERN WHITE PINE. Coweeta Hydrologic Lab., Asheville, N. C. J. D. Helvey.

Water Resources Res, Vol 3, No 3, pp 723-729, 1967. 2 fig, 5 tab, 16 ref.

Descriptors: *Interception, *White pine trees, *Water balance, *Evapotranspiration, Deciduous trees, Rainfall-runoff relationships, North Carolina, Appalachian Throughfall. Region, Mountain Stemflow.

Identifiers: Thornthwaite method.

Measurements of gross rainfall, throughfall, stemflow, and litter interception in three eastern white pine stands, age 10, 35, and 60 yr, in the Southern Appalachians of western North Carolina, were used to derive regression equations for estimating throughfall, stemflow, and the sum of throughfall and stemflow from measurements of gross rainfall. Equations for total interception loss were derived by algebraically combining losses from the canopy and litter. These equations were used to predict total seasonal interception loss from measurements of total seasonal rainfall and number of storms.

Total interception loss in white pine increased with stand age, and total loss from all pine stands studied exceeded losses calculated for mature hardwoods. During the dormant season, calculated monthly interception loss from mature hardwoods and white pine exceeded potential evapotranspiration calculated by the Thornthwaite method. W69-03315

THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS, Southern Forest Experiment Station, Harrison,

Edwin R. Lawson.

Water Resources Res, Vol 3, No 3, pp 731-735, 1967. 5 p, 3 fig, 3 tab, 6 ref.

Descriptors: *Interception, *Throughfall, *Stemflow, *Mixed forests, *Rainfall-runoff relationships, Arkansas, Forests, Hydrologic data, Coniferous forests, Deciduous forests. Identifiers: Ouachita Mountains (Arkansas).

In a pine-hardwood stand in the Ouachita Mountains of Arkansas, throughfall was strongly corre-lated with gross rainfall and long-term mean tem-perature on the calendar day of the storm, whereas stemflow was closely related to gross rainfall, crown diameter (or basal area at breast height), crown diameter (or basal area at breast height), tree height, and minimum temperature on storm date. Total interception averaged 15.1% of average annual gross rainfall and stemflow 2.4%. Thus, average annual interception loss was 12.7%. Nearly 75% of total stemflow was from hardwoods, which were primarily understory trees.

W69-03339

THE INFLUENCE OF RAINFALL INTERCEP-

TION ON STREAMFLOW,
Southeastern Forest Experiment Station, Franklin,

N. C. W. T. Swank

Clemson Univ. Counc. on Hydrol., Hydrol. in Water Resources Manage. Conf. Proc. 102-112,

Descriptors: *Interception, *Water yield improve-ment, Forestry, Evapotranspiration, *Streamflow, Throughfall, Stemflow, Watershed management, Deciduous forests, Coniferous forests, Hydrologic

aspects.

'dentifiers: *Experimental watersheds.

Data are presented which provide evidence that interception loss is a major hydrologic process which is involved in reducing the quantity and altering the timing of streamflow from watersheds in the Southern Appalachians when cover types are changed from mature mixed hardwoods to eastern white pine. The role of interception loss differences between loblolly pine and mature hardwoods in the Piedmont of South Carolina is discussed. W69-03384

COMPARISON OF THE DYE METHOD WITH THERMOCOUPLE PSYCHROMETER
MEASURING LEAF WATER POTEN-TIALS,

Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C. E. B. Knipling, and P. J. Kramer.

Reprint from Plant Physiol. 42 (10):1315-1320, 1967.

Descriptors: *Moisture stress, *Plant physiology, *Osmotic pressure, Hygrometry, Humidity, Microclimatology, Leaves, Turgidity, Vascular tissues, Transpiration, Moisture deficit, Trees. Identifiers: *Water potential, Forest trees.

The dye method for measuring water potential was examined and compared with the thermocouple psychrometer method in order to evaluate its usefulness for measuring leaf water potentials of forest trees and common laboratory plants.

INTERCEPTION BY EASTERN WHITE PINE, Southeastern Forest Experiment Station, Franklin,

J. D. Helvey.

Reprint from Water Resources Research 3 (3):723-729, 1967.

Descriptors: *Evapotranspiration, *Interception, *Stemflow, *Throughfall, Precipitation (Atmospheric), Raindrops, Evaperation, Watershed management, White pine trees.

Measurements of gross rainfall, throughfall, stemflow and litter interception in three eastern white pine stands, age 10, 35, and 60 years in the Southern Appalachians of Western North Carolina were used to derive regression equations for esti-mating throughfall, stemflow, and the sum of throughfall and stemflow from measurements of gross rainfall. Equations for total interception loss were derived algebraically combining losses from the canopy and litter. These equations were used to the canopy and litter. These equations were used to predict total seasonal interception loss (1) from measurements of total seasonal rainfall (sigma P) and number of storms (N). Equations for the 10-, 35-, and 60-year old stands are 1+0.05 (N)+0.08 (sigma P), 1=0.05 (N)+0.12 (sigma P), and 1=0.06 (N)+0.18 (sigma P), respectively. Total interception loss in white pine increased with stand age, and total loss from all pine stands studied exceeded losses calculated for mature hardwoods. During dormant season calculated monthly interception loss from mature hardwoods and white pine exceeded potential evapotranspiration calculated by the Thornthwaite method.

W69-03391

MEASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
Southeastern Forest Experiment Station, Franklin,
N. C.; and Duke Univ., Durham, N. C.

E. B. Knipling. Reprint from Ecology 48 (6):1038-1041, 1967.

Descriptors: *Moisture stress, *Plant physiology, *Osmotic pressure, Moisture uptake, Leaves, Turgidity, Vascular tissues, Transpiration, Moisture deficit.

Identifiers: *Water potential, Water movement.

The dye method for measuring leaf water potential is simple, inexpensive and suitable for both labora-

tory and field work. Leaves are immersed in a graded series of solutions, and the solution which neither gains nor loses water is assumed to have a water potential equal to that of the leaf. W69-03392

EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS, Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C.

E. B. Knipling.
Reprint from Physiol. Plant., 20:65-72, 1967.

Descriptors: *Plant physiology, *Moisture stress, Moisture deficit, Vascular tissues, Transpiration, Leaves, Turgidity, Moisture uptake, Osmotic pres-

Identifiers: *Dogwood, *Water potential, *Water deficit, Water movement.

Water deficit-water potential relationships were determined at approximately monthly intervals from May to August on leaves collected from dogwood trees growing in two environments. The relationships were not the same for leaves of different ages or for leaves of the same age, but growing in different environments. With aging of the leaves, the relationships shifted to progressively lower water potentials for a given water deficit. Increased leaf dry weight, decreased cell wall elasticity, and decreased osmotic potentials accompanied leaf aging. These changes and the shifts in the relationships were greatest for leaves growing under high light intensity and dry environmental conditions. The lack of constancy in the relationships reduces the usefulness of water deficit or relative turgidity as an estimator of water potential. For the purposes of some workers, however, the relationships may be sufficiently constant for mature leaves of a given species growing in a relatively constant environ-W69-03393

DESIGN CRITERIA FOR INTERCEPTION STU-

Southeastern Forest Experiment Station, Franklin,

J. D. Helvey, and J. H. Patric. I.A.S.H. Symp. Design of Hydrol. Networks 67:131-137, 1965.

*Interception, *Stemflow, Descriptors: *Throughfall, Precipitation (Atmospheric), Raindrops, Evaporation, Watershed management.

This report, gleaned from over fifty studies, defines variability of interception parameters and provides sampling designs for obtaining estimates to selected levels of probability for each parameter mean. A new method for estimating stemflow greatly reduces variability inherent in the traditional single-tree method. These sampling and analytical methods will insure that results of different studies are comparable. are comparable. W69-03395

SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
Pacific Southwest Forest and Range Experiment

Station, Berkeley, Calif. Robert R. Ziemer.

U S Department of Agriculture, Forest Service, Research Note PSW-166, pp 1-13, 1968. 13p, 13 map. 4 tab, 1 chart, 1 ref.

Descriptors: *Soil-plant-water relationships, *Water utilization, Pine trees, Forest soils, Soil moisture, Retention, Moisture content, Soil profiles, Summer, California. Identifiers: *Sugar pine trees, *Sierra Nevada Mountains.

Soil moisture was measured around an isolated mature sugar pine tree (Pinus lambertiana Dougl.) in

Field 02-WATER CYCLE

Group 21—Water in Plants

the mixed conifer forest type of the north central Sierra Nevada, California, from November 1965 to October 1966. From a sequence of measurements, horizontal and vertical soil moisture profiles were developed. Estimated soil moisture depletion from the 61-foot radius plot for the 1966 summer depletion season was 22.57 inches.

THE HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND VARIABILITY,
Technische Hochschule, Darmstadt (West Ger-

many). Botanisches Institut.

O. L. Lange.

Arid Zone Research 25. Unesco, Paris, 1965. pp 399-405, 7 p, 5 fig, 52 ref, disc.

Descriptors: Physiological ecology, *Heat resistance, Arid climates, *Heat, *Thermal stress, Heating, Ecology, *Plant physiology, Cytological studies, Variability, Metabolism, *Environmental effects, Resistivity. Identifiers: Heat injury.

In the arid zones of the world, the heat resistance of plants has a special ecological significance. Its determination is necessary to understand relationships existing between plants and their surroundings and to investigate the possibility of their existence in different localities. The fundamental considerations to be taken into account when measuring heat resistance are given. Since heat damage to a plant depends directly upon the time of heating, the period of heating must be accurately defined. For determination of heat injury, besides measurement of metabolic activities like respiration or photosynthesis, there exists a number of cytological criteria which should be used with care. Within a certain limit, characteristic for each species, heat tolerance can show variations within the same organism, depending upon exogenous or en-dogenous factors. The heat resistance of plants must be known in order to determine their ability to survive in hot arid climates. (Blecker-Ariz) W69-03485

EFFECT OF EXTERNAL SALT CONCENTRA-TIONS ON WATER RELATIONS IN PLANTS: II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN EXTERNAL MEDIUM AND XYLEM
ON WATER RELATIONS IN THE ENTIRE

PLANT,
California Univ., Riverside. Citrus Research Center
and Agricultural Research Station.
J. J. Oertli.

Soil Sci, Vol 102, No 4, pp 258-263, October 1966. 6 p, 1 fig.

Descriptors: *Osmotic pressure, *Circulation (Plants), Turgidity, *Translocation, *Xylem, Transpiration, Soil-water-plant relationships, Root ranspiration, Soil-water-plant relationships, Root systems, *Salinity, Plant physiology, Moisture uptake, Humidity, Leaves, Absorption, Cytological studies, Stomata, Crop response. Identifiers: Water potential.

The purpose of the paper is to consider passage of water from solution or soil through the plant into the free atmosphere. This movement of water must be considered in order to predict what will happen to the osmostic adjustment of root xylem sap un saline soil conditions. Changes of water potential in root medium, due to salinity, are small in relation to the entire potential drop and should not have an effect on the transpiration rate unless there are secondary changes within the plant. Measurements secondary changes within the plant. Measurements of transpiration rates or of osmotic pressures of expressed leaf sap have little bearing on whether turgidity is maintained or not. At high external humidity (low transpiration), the model predicts a qualitatively correct dependence of root pressure on external concentrations. (Blecker-Ariz) GERMINATION STUDIES ON ARID ZONE

TREE SEEDS, Central Arid Zone Rsearch Institute, Jodhpur (In-

R. N. Kaul and Man Singh Manohar. Indian Forester, Vol 92, No 3, pp 499-503, August 1966. 5 p. 3 fig.

Descriptors: *Germination, *Seeds, *Viability, Descriptors: "Germination, "Seeds, "Viability, *Arid climates, Field capacity, Moisture availability, *Moisture stress, Wilting point, Drought resistance, Mature growth stage. Identifiers: *Seed coats, Water potential, Seed

dormancy.

Dormancy of most Acacia species is commonly as-Dormancy of most Acacia species is commonly associated with presence of a hard seed coat. Knowledge of extent of seed dormancy and germinability under different degrees of moisture stress is essential for raising plantings of Acacia senegal in arid zones characterized by recurrent droughts. Trials were carried out to investigate extent of seed dormancy, its causes and possible remedies, and extent of germinability of seeds of different maturities under different moiture stresses. Seeds without seed coats gave 94% germination, compared to seed with intact coats which showed only 4% germination. With the decrease in water potential there was a corresponding decrease water potential there was a corresponding decrease in cumulative germination % of seeds at successive days after sowing. Germination began a day earlier in fully mature seeds, as compared to the least mature seeds. Seed germination was considerably reduced with decline in availability of moisture from field capacity to near wilting point. (Blecker-Ariz) Ariz) W69-03489

DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS, Welder Wildlife Foundation, Sinton, Tex.; and Texas Technological Coll., Lubbock. Albert D. Chamrad, and Thadis W. Box. Ecology, Vol 46, No 6, pp 780-785, Autumn 1965. 6 p, 2 fig, 3 tab, 25 ref.

Descriptors: *Drought resistance, Moisture deficit, Droughts, *Moisture stress, *Mortality, *Environmental effects, *Range grasses, Drought tolerance, Texas, Semiarid climates, On site-investigations, Fine-textured soils.

The objective of the study was to compare and The objective of the study was to compare and evaluate mortality of native grasses in relation to soils, species, and size of grass clones. The native grasses were seacoast bluestem, silver bluestem, filly panicum, Pan American balsamscale, buffalograss and brownseed paspalum. The area of study was in South Texas which had had a severe drought which began in the fall of 1961 and lasted through the spring of 1963. The soil types were clay, fine sand and fine sandy loam. The lowest mortality for seacoast bluestem occurred on the clay and the highest occurred on the fine sandy loam. Differences in percentage mortality between clay and the highest occurred on the fine sandy loam. Differences in percentage mortality between soils and between species on given soil types were highly significant. In some instances a significant positive correlation existed between size of grass clones and the percentage of mortality. As the diameter of clones increased, percentage mortality increased. (Blecker-Ariz) W69-03495

PERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE FOR GROWTH, INCREASE FORAGE FOR BROWSING,
Forest Service, Fort Collins, Colo.
C. J. Campbell.
U S Forest Service Research Note RM-76, 1966. 4

Descriptors: *Tamarisk, Weed control, *Riparian plants, Forages, *Evapotranspiration, *Cutting management, Water conservation, Arizona, management, Water conservation, Arizona, *Browse utilization, Carbohydrates, Crop production, Mortality, Identifiers: Defoliation.

In central Arizona the effects of partial and complete defoliation of tamarisk (Tamarix pentandra Pall.) were determined at various weekly interdra Pall.) were determined at various weekly intervals throughout the growing season and possible water savings which resulted from such treatments were studied. Plants were clipped at 2-, 4-, 8-, and 24-week intervals during the growing season. Plant mortality increased with the frequency of clipping. Mowings in May, July and September are necessary Mowings in May, July and September are necessary to keep foliage succulent and within reach of browsing cattle. Evapotranspiration decreased approximately 50% following mowing treatments. Tamarisk can be suppressed on flood plains and reservoir deltas in arid climates by periodic mowing. (Blecker-Ariz) W69-03496

THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT MICROHABITATS OF WADI HOFF,

Cairo Univ. (Egypt). Dept. of Botany.
A. A. Abd El Rahman, and K. H. Batanouny.
J of Ecology, Vol 53, No 1, pp 139-145, March
1965. 7 p, 2 fig, 21 ref.

Descriptors: *Arid climates, *Desert plants, *Habitats, Density, Environmental effects, *Soil moisure, *Transpiration, Wet seasons, *Microenvironment, Moisture availability, Weight, Dry seasons, Climatology.

Identifiers: *Wadi, Florestics, Fresh weight

(Plants).

The total water output of desert vegetation was estimated in the different microhabitats of Wadi Hoff, one of the wadis of the Egyptian Arabian desert. The areas under study were the plateau, the shaded area and the first and second terraces of the wadi bed. The total water output depended on different factors: the fresh weight of plants, their density, the climatic factors, the floristic composition and the availability of soil moisture. In the wet season, the total water output was nearly equal in the plateau and the shaded microhabitat although the total fresh weight of plants in the plateau was only one third of that in the shade. This was mainly attributed to the effect of shade in decreasing the transpiration rates. In the dry season the water outtranspiration rates. In the dry season the water output showed a slight increase in most microhabitats due to the rise in the transpiration rate of plants. (Blecker-Ariz) W69-03501

EFFECT OF HIGH TEMPERATURES ON MOISTURE DEPLETION, IMBIBITION AND GERMINATION OF SEEDS OF MIMOSA HAMATA WILLD, Jodhpur Univ. (India). Dept. of Botany.
U. N. Chatterji, and Achala (nee' Chatterjee)

Mukherjee.
Ann of Arid Zone, Vol 7, No 1, pp 93-99, March 1968. 7 p, 3 tab.

Descriptors: *Temperature, *Seeds, *Germination, Moisture stress, *Moisture deficit, Moisture uptake, *Thermal stress, Heat, Drying, Root systems, Absorption, Crop response, Plant physiology, Embryonic growth stage. Identifiers: Imbibition.

Seeds of Mimosa hamata were subjected to temperatures of 70, 90, and 100 deg C for 24, 48, 96, and 144 hours to study what effect exposing seeds to high temperature would have on germination. The seeds which had a higher depletion of moisture germinated poorly in comparison to those seeds which lost a lesser amount of moisture. The treatment of 70 deg C for 144 hours gave the highest percentage of germination. There was a direct correlation between the rate of imbibition and the degree and duration of the temperature of the viability of the embryo, and might be a physical process related to the colloidal particles found in the cells composing the seed. Radicle growth was found to be stunted by exposure to high temperatures. There was no significant difference in the behavior of large and small seeds with regard to their capacities for imbibition and germination as a

Erosion and Sedimentation—Group 2J

result of their exposure to dry heat treatment. (Af-

RATES OF SLOPE DEGRADATION AS DETER-MINED FROM BOTANICAL EVIDENCE,
WHITE MOUNTAINS, CALIFORNIA,
Geological Survey, Washington, D. C.
Valmore C. LaMarche, Jr.

Geol Surv Prof Pap 352-I, pp 341-377, 1968. 37 p, 36 fig, 2 plate, 8 tab, 39 ref.

Descriptors: *Bank erosion, *Dendrochronology, *Bristlecone pine trees, Weathering, Topography, Slopes, Age, Exposure.
Identifiers: *Slope degradation, *Exposed tree

roots, Root age.

Described are the development and application of methods for obtaining long-term rates of slope degradation in areas where the exposed roots of old trees bear record of the prior levels of a progressively lowered land surface. Methods of calculating slope degradation were developed by studying roots in relation to age of ancient bristlecone pines in dolomite areas in the semi-arid White Mountains. Exposed tree roots are direct evidence of degradation, and local degradational rates are estimated from tree or root age and depth or root ex-posure. The best estimates of long-term rates of slope degradation are those based on study of samples containing a relatively large number of specimens from small topographically homogene-ous areas. Transport rates of products of rock weathering on slopes and in stream channels are concluded to be great enough to account for the estimated degradational rates. (Llaverias-USGS) W69-03527

A SUGGESTED METHOD FOR ESTIMATING EVAPOTRANSPIRATION BY NATIVE PHREATOPHYTES, Geological Survey, Menlo Park, Calif. S. E. Rantz.

Geol Surv Res 1968, Prof Pap 600-D, pp D10-D12, 1968. 3 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Evapotranspiration, *Phreatophytes, Environmental effects, Plants, Water levels, Water

Identifiers: Blaney-Criddle method, Blaney-Criddle coefficient selection charts.

A graph and table have been developed for selecting values of the coefficient K to be used in the mg values of the coefficient K to be used in the Blaney-Criddle formula for estimating evapotranspiration by native phreatophytes. Values of K are dependent on the species of phreatophyte, the density of growth, and the depth to water table. (USGS)
W69-03557

2J. Erosion and Sedimentation

EXPERIMENTAL INVESTIGATION AND COM-PUTATION OF THE VOLUME OF MATERIAL DERIVED FROM DEEP RAVINES IN FORECASTING THE SILTING OF RESER-VOIRS ON MOUNTAIN RIVERS, Sredneaziatskii Nauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR). A. Ye Mal'tsev. Transl from Izvestiya Akademii nauk Uzbek-skovssr, seriya technicheskikn nauk, No 6, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 402-404, 1967. 3 p. 4 fig. 2 tab.

1967. 3 p, 4 fig, 2 tab.

Descriptors: *Sediment transport, *Sediment discharge, *Ravines, *Reservoir silting, *Bed load, Suspended load, Dams.
Identifiers: USSR, Fergana Valley.

The bed loads of mountain ravines tributary to the roposed reservoir in the Fergana Valley, USSR, were measured to estimate reservoir sedimenta-tion. Rainfall and discharge were measured in 1960. Bed load was measured by construction of a rockfill filter dam 1.5 m high and 0.5 m wide constructed to trap material larger than about 5 cm. The volume of trapped coarse material was measured after each flow in the ravine. Current velocities were measured by floats. The relationship between daily rainfall and streamflow is shown graphically. Stream turbidity is tabulated. In the period of observation, a total of 16.24 cu m was deposited, and it was calculated that 120 cu m of suspended load was carried. (Knapp-USGS) W69-03216

EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,

Johns Hopkins Univ., Baltimore, Md. M. Gordon Wolman, and Asher P. Schick.
Water Resources Res, Vol 3, No 2, pp 451-464, 1967. 14 p, 3 fig, 5 tab, 29 ref.

Descriptors: *Sediment yield, *Construction, *Urbanization, Maryland, District of Columbia, Virginia, Sediment load, Hydraulics. Identifiers: Fluvial sediment.

The effects of construction and urbanization on sediment loads of streams in the Washington and Baltimore urban and suburban areas were studied. The rapidly developing areas are on the Coastal Plain and Piedmont. Slopes have deep soil and gradients are mostly 1-10% but some are over 20%. Annual precipitation is 42 in., evenly distributed areally, and with high summer intensities. Average sediment yield is 200-500 ton/ sq mi/yr. Past intensive farming caused yields of 2-5 times present amounts, but farming has declined markedly. Construction areas yield up to 140,000 tons/sq mi/ yr with sediment concentrations of 3,000 to over 150,000 ppm while natural and farm area yields are not over 2,000 ppm. Sediment storage occurs on construction sites and in valley bottomlands. The increased sediment loads in streams cause channel bar deposition, bank erosion, flow obstruction, bar Geposition, bank erosion, flow obstruction, flooding, changing channel morphology, blanketing of bottom flora and fauna, alteration of flora and fauna by environmental change, and fish species alteration. Building permits show that 50% of sites were open 8 months, 60% for 9, and 25% over 1 yr. Activity is almost constant through the year. Average site size is 14,400 sq ft. A minimum of 7.2 sq mi are open at any one time. Housing accounts for 5.7 sq mi and highways for 1.5 sq mi. Sediment yield is 700-1800 tons per 1000 increase in population. (Knapp-USGS) W69-03227

SEDIMENTATION IN A MEANDERING ESTUA-

RY,
Lehigh Univ., Bethelem, Pa. Marine Science
Center; Georgia Univ., Sapelo Island, Ga., Marine
Inst.; and Georgia Univ., Athens. Dept. of Geology.
Lynton S. Land, and John H. Hoyt.
Grant NSF G-16426. Study supported by National
Science Foundation Grant. Sedimentology, No 6,
pp 191-207, 1966. 17 p, 9 fig, 33 ref.

Descriptors: *Sedimentation, *Estuaries, Aggradation, Bank erosion, Meanders, Sand waves, Sand bars, Beaches, Georgia. Identifiers: Sapelo Island (Georgia).

Sand is being deposited in a meandering estuary separating Sapelo and Blackbeard Islands, Georgia, in the channel of the estuary and on two point bars associated with meanders. Sand eroded by the meandering channel from slightly lithified Pleistocene and unconsolidated Holocene strandline deposits is redeposited by the ebb tidal currents. The estuary-channel deposits are course grained and their grain-size decreases down ebb current from the source outcrops. The point bars are elongated in the direction of the ebb current, and grain-size increases from their crests downward as they grade into the channel deposits. downward as they grade into the channel deposits.

Festoon crossbedding and ripple marks on the point bars record the ebb direction, while elongated plant fragments are preferentially oriented normal to the bar elongation (current). Horizontally stratified muds and muddy sands are being deposited behind the bars, and contain a rich fauna (primarily annelids, arthropods, and molluscs). However, the fauna is represented in the deposits more by burrows and disturbed stratification than by preserved organisms. The sands of the bars and channel are biologically less productive but the bioclastic content of the sediment is high. (Knapp-W69-03228

RECENT DELTAIC DEPOSITS OF THE MISSIS-SIPPI RIVER: THEIR DEVELOPMENT AND CHRONOLOGY.

Esso Production Research Co., Houston, Tex.

David E. Frazier. Trans Gulf Coast Ass Geol Soc, Vol 17, pp 287-315. Oct 1967. 19 p, 13 fig, 35 ref.

Descriptors: *Deltas, *Mississippi River, *Sedimentation, Provenance, Stream erosion, Deposition (Sediments), Radioactive dating. Identifiers: *Chronology, Delta Complex.

Sixteen separate delta lobes have been formed by the Mississippi River in the past 6,000 years; 14 form the Teche, St. Bernard, and Lafourche delta complexes and the remaining 2 form the present birdfoot delta, which is an extension of the earlier formed initial lobe of the Plaquemines-Modern complex. Each delta complex is genetically related to a major Mississippi River course. Individual delta lobes within each complex are the result of the successive distributary networks of a major river course. Delta lobes were defined by detailed facies analyses of sediment cores from hundreds of shallow borings combined with lithologic and fausnail ow forms combined with intrologic and rath-nal data from several hundred additional borings. Each lobe consists of a basal fine-grained prodelta facies, an overlying sandy delta-front facies, and uppermost fine-grained delta-plain facies, includ-ing peat accumulations and nonorganic flood-plain and natural-levee deposits. Radiocarbon dates together with the facies relationships, indicate that the development of each delta complex was not a continual process, but the river shifting from one major course to another caused the temporary cessation of development in one delta complex as progradation occurred in another. Similar deltaic sequences extend basinward as massive subsurface clastic wedges which constitute a major portion of the peripheral basin fill. (Knapp-USGS) W69-03230

ERODIBILITY INDICES FOR WILDLAND SOILS OF OAHU, HAWAII, AS RELATED TO SOIL FORMING FACTORS, Pacific Southwest Forest and Range Experiment

Station, Berkeley, Calif. Teruo Yamamoto, and Henry W. Anderson. Water Resources Res, Vol 3, No 3, pp 785-798, 1967. 14 p, 2 fig, 11 tab, 38 ref.

Descriptors: *Erosion, *Soils, *Hawaii, Geology, Topography, Vegetation, Regression analysis, Soil aggregates, Soil formation, Soil properties, Soil conservation. Identifiers: Multivariate analysis, Soil erodibility,

Oahu, Suspension percent.

Soil samples collected along 31 transects in the watersheds of the Koolau and Waianae ranges were analyzed in the laboratory for the size distribution analyzed in the laboratory for the size distribution of water-stable aggregates and the suspension percent, a measure of easily dispersed silt and clay in the soil. Indices of soil erodibility were related by principal component analyses with varimax rotation to these 7 soil-forming factors: parent material, rainfall, elevation, vegetation type, slope, aspects, and zone. Parent rock material was the most important factor in explaining variation of water-stable aggregates of soils in Hawaii. Nevertheless, differences in water-stable aggregates were also as-

Group 2J—Erosion and Sedimentation

sociated with differences in vegetation type and other soilrforming factors. Most of the soils studied were rated as slightly to moderately erodible under full vegetative cover. The loose condition plus the dispersive and slaking characteristics of volcanic ash soils suggest that they may be twice as erodible as soils of basaltic flow or of colluvial origin. Among the soil characteristics that serve as indices of erodibility, the surrengian personal was found to of erodibility, the suspension percent was found to be independent of other measures; hence, it may be expected to serve well as a part of an erodibility ratio, such as suspension-mean weight diameter or a surface-aggregation ratio. Conversion of the native koa-ohia scrubby forests by planting paperbark or silk-oak trees promises to result in development of less erodible soils as well as more useful forest products.

AN ANALYSIS OF RELATIONSHIPS BETWEEN FLOW CONDITIONS AND STATISTICAL MEA-SURES OF BED CONFIGURATIONS IN STRAIGHT AND CURVED ALLUVIAL CHAN-

Iowa Univ., Iowa City. Water Resources Research

David Squarer.
Ph D dissertation, June 1968. 173 p, 31 fig, 5 tab, 62 ref. OWRR Project A-015-Ia.

Descriptors: *Sediment transport, *Statistical methods, Markov processes, Correlation analysis, Time series analysis, Digital computers, Froude number, Channel morphology. Identifiers: Spectral analysis, Autocorrelation, Spectral density, Probability density.

A statistical investigation was made of sediment transport in sinuous channels and the results were compared with data from straight-flume experimental studies. Geometry of bed forms was studied by analyzing records of streambed profiles for auby analyzing records of streamoed profiles for au-tocorrelation, spectral density, and probability den-sity functions of bed elevation as a function of channel length or of elapsed time. Sediment trans-port rate in a curved channel is about 15 times as much as in a straight flume with the same flow conditions. The difference increases with increasing Froude number. The mean water surface slopes in the straight and curved channels are comparable. Bed friction can be determined either in terms of flow or bed geometry. A statistical method is presented to obtain bed wave lengths and heights in terms of moments of spectral density functions. Characteristic bed form dimensions can be obtained from both stationary and nonstationary samtained from both stationary and nonstationary sample records. Small ripples move faster than large ones and ripple celerity increases with flow velocity. Theoretical second order linear Markov models as well as other simple exponential, sine, cosine, and spectral density functions do not fit the observed phenomena. (Knapp-USGS)

SEDIMENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN CADDO AND GRADY COUNTIES, OKLAHOMA, Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div. P. B. Allen, and N. H. Weich. Water Resources Res, Vol 3, No 3, pp 777-784, 1967. 8 p, 8 fig, 3 tab, 5 ref.

Descriptors: *Sediment yield, *Sediment transport, *Channel morphology, *Provenance, Geology, Oklahoma, Erosion, Watersheds (Basins). Identifiers: Sediment yield-lithologic relationships, Drainage basin characteristics, Washita River, Einstein method, Colby method, Brooks method.

Sediment yields for 9 experimental watersheds, sectiment yields for 9 experimental watersheds, whose drainage areas vary from 26.0 to 3290 sq mi, were related to the geology in the watersheds. Yields from watersheds with mixed sandstone, silt-stone, and shale geology were higher than for watersheds where the geology was predominantly sandstone. The highest yield rate was 29.7 in. per 1000 yr for a mixed geology watershed, the lowest yield rate being 1.32 for a sandstone watershed. Stream channel shape was found to be related to the material in transport. Streams with large sand loads have wide, shallow channels, whereas streams with a predominantly silt load have narrow, deep channels. The correlation between the temperature of the flow and sediment concentration was+ 0.93. Several total load predictions made with the Colby and modified Einstein procedures were compared with those made with the Brooks total suspended load equation when field-determined sediment z values and velocity k values were used. Computa-tions by the modified Einstein and Colby method compared favorably with those made by the Brooks W69-03326

A COMMENT ON HORTON'S LAW OF STREAM NUMBERS,

IBM Watson Research Center, Yorktown Heights.

For primary bibliographic entry see Field 02E. For abstract, see . W69-03338

INTRODUCTION TO PALEOLIMNOLOGY,

Texas Technological Coll., Lubbock. Dept. of Geosciences. C. C. Reeves, Jr.

No. 11 in series on Developments in Sedimentology. New York, Amer Elsevier Pub Co, Inc, 1968. 238 p, 22 tab, 125 illus, ref, index.

Descriptors: *Paleolimnology, *Lake basins, *Lakes, *Sedimentology, Chemical precipitation, Detritus, Deposition (Sediments),

Pleistocene epoch, Structures.
Identifiers: *Lacustrine environment, *Textbook, Detrital sediments

Summarizes the multiple methods used in paleolim-nology, based on studies by the author of fluvial lake basins in the southwestern United States and in Mexico. Part 1 describes the lake basins, their formation and quantitative aspects and their shape and development. Part 2 tells of the lacustrine environment, dividing the lacustrine sediments into chemical precipitates and clastic materials; and lacustrine structures are described as depositional lacustrine structures are described as depositional and erosional features. Part 3 discusses the Paleolake Basin and deals with Pleistocene chronology, the distribution, cause, and recognition of the basins. Paleoclimatic and sampling methods are given and future paleolimnological applications presented. (Lang-USGS) W69-03342

CYCLIC SEDIMENTATION,

Edinburgh Univ. (Scotland). Grant Inst. of Geolo-

gy. P. M. D. Duff, A. Hallam, and E. K. Walton. No. 10 in series on Developments in Sedimentology. New York, N.Y., Amer Elsevier Pub Co, Inc, 1967. 290 p, 35 tab, 91 illus, ref, index.

Descriptors: *Sedimentation, *Cycles, Sediment distribution, Sediments, Environmental effects, Marine geology, Microorganisms, Clays, Sands, Aggradation, Deltas, Erosion, Running waters. Identifiers: *Cyclic sedimentation, Source book, Fluvial and lacustrine regimes.

A comprehensive and critical treatment is presented of cyclic sedimentation. Although the subject of sedimentology cycles has been argued about since the early 1800's and resulted in voluminous literature, no complete survey of all the aspects of cyclic sedimentation has previously been done. The book discussed and illustrates cycles in fluvial, lacustrine, and transitional regimes in North America and Europe. Details on epicontinental marine environments and sedimentary cycles and faunal changes are presented with conclusions. Many references are given. (Lang-USGS) W69-03353

PALEOECOLOGICAL STUDIES OF POTATO) LAKE AND ITS ENVIRONS,

LAKE AND ITS ENVIRONS, Indiana Univ., Bloomington. Melbourne C. Whiteside. Ecology, Vol 46, pp 807-816, Autumn 1965. 10 p, , 5 fig, 1 tab, 22 ref.

Descriptors: *Pollen, *Eutrophication, *Paleolim-nology, Lakes, Sedimentation, Chemical analysis, Cores, *Erosion, Watersheds (Basins), Ecology,

Arizona.

Identifiers: Paleoecological studies, Lake sediment cores, Pollen analysis, Chemistry of cores, Historical lake ecology, Watershed erosion, Lake succession, Recent sediments, Potato Lake (Ariz).

A 286-cm core was taken from the center of Potato Lake, Coconino Co, Ariz. Pollen, chemical, and physical analyses were made on the sediment. Pollen evidence implying a period of cool moist condi-tions was represented by the sediments below 120 cm. The correlations of the lower level of sedicm. The correlations of the lower level of sediments with this period are confirmed by a radio-carbon date of 14,400 plus or minus 300 years at depth of 1.42-1.72 cm. The warming trend of post-glacial time is evidenced by the increase in pine which replaced spruce-fir as the predominent ar-boreal pollen in the sediments accumulated above the 120-cm level. Loss on ignition (considered to represent lost of total organic material) of the sediment increases above the 120 cm level corresponding to the onset of eutrophication in Potato Lake. A drastic reduction in percentage of organic material ing to the onset of eutrophication in Potato Lake. A drastic reduction in percentage of organic material occurs at the uppermost portion of the core. The recent increase of inorganic material at this level is attributed to increased erosion of the basin following the activities of man in the drainage basin, ie., logging and grazing. W69-03361

PHOSPHATE EQUILIBRIUM B REDUCED SEDIMENTS AND WATER, BETWEEN

Copenhagen Univ., (Denmark). Dept. of Plant

For primary bibliographic entry see Field 02K. For abstract, see . W69-03365

RECENT SEDIMENTS OF THREE WISCONSIN

LAKES, Shell Oil Co., Houston, Tex. Raymond C. Murray. Bull Geol Soc Amer, Vol 67, pp 883-910, July 1956. 28 p, 10 fig, 2 plate, 3 tab, 28 ref.

Descriptors: *Lakes, *Wisconsin, *Sediments, Cores, Diadenesis, Carbonates, Organic matter, Marl, Sludge, Sedimentation, Eutrophication. Identifiers: Recent sediments, Lake Mendota (Wis), Lake Wingra (Wis), Trout Lake (Wis), Clastics, Paleoecology.

Sedimentation in Lake Mendota, Wis, has changed abruptly in the recent past. Cores record this as a sharp interface separating buff marl from overlying 1-14 inches of black sludge. The marl and sludge differed in being high-carbonate, low-clastic and low-carbonate, high-clastic, respectively, but their organic content was essentially the same. Author ascribes change to increased deposition of clastic materials as a consequence of farm and domestic practice. Contemporaneously, increased biological productivity and consequent hypolimnetic oxygen minima have occurred, possibly resulting from domestic drainage. Blackness of sludge results from anaerobic deposition of ferrous sulfide, not from organic content. Dark green sediments of Trout Lake, Wis, were highly organic. Complete sections of sediments, when available, showed increased organic content with advancing time. Most recent sediments showed slight decrease in organic content, which author ascribes to recent increased clastic deposition. Recent bottom deposits of Lake Wingra, Wis, consist of gray marl which become shell marl in shallow water. Author found no evidence supporting theory that important diagenetic changes are taking place in the sediments studied. Exclusive of compaction and water Sedimentation in Lake Mendota, Wis, has changed

loss, post-depositional changes appeared to be restricted to upper few inches of most recent record. (Eichhorn-Wisc)
W69-03367

STABILIZING ERODING STREAMBANKS IN SAND DRIFT AREAS OF THE LAKE STATES. North Central Forest Experiment Station, St. Paul, Minn.

Edward A. Hansen.

U S Department of Agriculture, Forest Service, Research Paper NC-21, pp 1-12, 1968. 12 p, 3 fig, 1 map, 8 photo, 1 chart, 17 ref.

Descriptors: *Sands, *Bank erosion, *Bank stabilization, Bank protection, Riprap, Stream erosion, Vegetation establishment, Slope stabilization, Soil stabilization, Erosion control, Sedimentation rates, Sediment Iwad, Aquatic environment, Costbenefit analysis, Great Lakes. Identifiers: *Lake States.

Bank protection planning balances the immediate real cost of stabilization against a probable future benefit. The immediate cost of stabilization can be estimated fairly accurately and can be improved upon with the experience gained from treating the first few banks. Future benefits, such as protection of on-site values or reduction in reservoir or lake sedimentation rates, can be estimated and expressed in economic terms. However, the possible future benefit from attempting to increase fish population through bank stabilization is obscure. Consequently, present justification of such an objective will have to be stated in qualitative terms such as reduced sediment load or possibly improved fish habitat. There is a wide variety of stabilization techniques that can be used for bank protection. Rock rip-rap is probably the best material to use for stabilizing the lower bank, since there is little that can deteriorate with time. However, rock of sufficient size and quantity is often difficult to obtain in the Lake States. In such cases, alternative methods employing wire, wood, or live vegetation must be used. The upper bank will revegetate naturally. However, sloping and application of seed, fer-tilizer, and mulch will accelerate the revegetation process. Maintenance should be a planned part of a bank-stabilization program because of the possibility of some structural failure in the future and the start of new points of erosion from normal stream meandering. W69-03405

A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND DISCHARGE AND DETAILED DISTRIBUTION, BED TO SUR-FACE, Corps of Engineers, Vicksburg, Miss.

F. B. Toffaleti.

Army Corps Eng, Nov 1968. 29 p, 15 fig, 2 tab, 11 ref, 3 append. Tech Rep No 5, Comm Channel Stabilization, U S

Descriptors: *Sedimentation, *Sediment transport, *Mathematical models, *Digital computers, *Computer programs, Sands, Silts, Rivers, Streams, Flumes, Model studies, Hydraulic models. Identifiers: Sand discharge computation.

A mathematical procedure and digital computer program are presented for solving sedimentation problems in the design of multipurpose, flood-control, navigation, channel rectification, and miscellaneous hydraulic structure projects. Only a few input data are required to describe quantitatively the sand fraction and the total sediment discharge. Sediment discharge profiles from bed to surface may be calculated. The method was tested in all types and sizes of rivers under a full range of flow conditions and in flume models. A flow chart, program listing, and sample computation are included. (Knapp-USGS) W69-03541

DIFFUSION AND SETTLING OF SEDIMENTS

AT RIVER MOUTHS: A COMPUTER SIMULA-TION MODEL, Stanford Univ., Calif. Dept. of Geology; and Stan-ford Univ., Calif. Dept. of Civil Engineering. G. F. Bonham-Carter, and Alex J. Sutherland. Trans Gulf Coast Ass of Geol Soc, Vol 17, pp 326-338, 1967. 13 p, 14 fig, 5 ref. NR 388 081, N00014-66-C0017-A04.

Descriptors: *Sedimentation, *Deltas, *Computer models, Digital computers, Computer programs, Dispersion, Settling velocity. Identifiers: Fortran programs.

A FORTRAN IV computer program for simulating the diffusion and settling of suspended sediment at river mouths is presented. The rate of sediment accumulation at any point in front of the channel mouth is governed by water and sediment discharge, sediment grain size distribution, sediment density, the porosity of the resulting sediment, width and depth of the river channel, and the geometry of the basin. A plane jet model is used for determining the velocity field and the rates of sediment diffusion. By adjusting the input parameters, a variety of 'delta' deposits may be created. The shape and foreset slope of the delta fan is found to be closely controlled by grain size and discharge. By allowing the model to respond dynamically to the accumulation of sediment at the channel mouth, a distributary mouth bar and submerged levees can be formed. Delta simulation experiments are monitored by printing maps showing the rates of sedimentation for each grain size at every cell in a digital accounting grid, and by facies maps using alphabetic symbols. Maps and stratigraphic cross sections are drawn with a digital plotter.

2K. Chemical Processes

DEUTERIUM CONTENT IN NATURAL WATERS.

Institut Prikladnoi Geofiziki, Leningrad. Trudy (USSR). V. A. Molochnova, M. M. Sokolov, and A. V.

Transl from Geokhimiya, No 5, 1967 (Russian). Geochem Int, Vol 4, No 3, pp 484-489, 1967. 6 p, 5

Descriptors: *Deuterium, *Crystalline rocks, Stable isotopes, Water quality, Water analysis, Geochemistry, Groundwater, Aquifers. Identifiers: *USSR, Hydrology crystalline terranes, Photoneutron method, Ukraine, Kazakhstan.

Deuterium content in groundwaters from Precambrean crystalline rocks of the Ukrainian shield and brean crystalline rocks of the Ukrainian shield and from Upper Paleozoic volcanic and sedimentary rocks of Central Kazakhstan, USSR, was determined by the photoneutron method. The deuterium content of 74 groundwater samples from the Ukrainien shield ranges from 0.0118 to 0.0233 mol.%, although most samples have a concentration of 0.0143 to 0.0148. Deuterium concentration appears to increase with depth. Higher deuterium concentrations occur in waters with high organic content; whereas the lower deuterium concentrations occur in waters with high radioactive content. Most of the 56 samples from the Central Kazakh stan region have deuterium concentrations of 0.0148 plus or minus 0.0003 mol.%. Higher concentrations are restricted to waters with high salinity; lower concentrations are found in waters with relatively low salinity. These data indicate that in igneous terranes the deuterium concentrations of shallow groundwaters are similar to the deuterium content of the large rivers, which is 0.0148 to 0.0149 plus or minus 0.0003 mol.%. Higher con-0.0149 plus or minus 0.0003 mol.78. Figher con-centrations are found in groundwaters with high or-ganic content and high salinity; lower concentra-tions are associated with groundwaters with high radioactive elements and low salinity. (Steinhilber-W69-03229

ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES, Vsesoyuznyi Nauchno-Issledovatelskii Institut Yadernoi Geofiziki i Geokhimii, Moscow (USSR). For primary bibliographic entry see Field 02F. For abstract, see. W69-03244

ISOTOPIC COMPOSITION OF LEAD IN NATU-RAL WATERS

Institut Prikladnoi Geofiziki, Leningrad. Trudy

(USSR). P. F. Andreyev, N. M. Bugrov, and V. S.

Glebovskaya.

Transl from Geokhimiya, No. 6, 1967 (Russian). Geochem Int, Vol 4, No 3, pp 551-556, 1967. 6 p, 5 tab, 11 ref.

Descriptors: *Lead radioisotopes, *Radioisotopes, Water analysis, Surface waters, Groundwater, Aquifers, Geochemistry, Methodology. Identifiers: USSR, Isotopic fractionation, Spectrometric, Analysis, Ukraine, Kazakhstan.

Data are presented on the isotopic composition of lead in surface and groundwaters in several regions in USSR. Included is a description of the technique used in the field to concentrate the lead in the water samples. Isotopic determinations were made spectrometrically and spectroscopically. Isotopic composition of lead in waters of large basins (Sea of Azov and Lake Balkhash) is similar. Lead isotope composition varies in the rivers and is considerably different from that in the large lakes. The isotopic composition of lead varies considerably in groundwaters from several aquifers in Kazakhstan and the Ukraine. In Kazakhstan, the isotopic composition of lead in the groundwaters is similar to that of the rocks in which these waters circulate. (Steinhilber-USGS) W69-03245

APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, CALIFORNIA, MOJAVE RIVER VALLEY,

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 02F. For abstract, see.

INTRODUCTION TO PALEOLIMNOLOGY, Texas Technological Coll., Lubbock. Dept. of

For primary bibliographic entry see Field 02J. For abstract, see . W69-03342

PHOSPHORUS RELEASE FROM BOG LAKE

Wisconsin Univ., Madison. Dept. of Soil Science; and Wisconsin Univ., Madison. Dept. of Zoology. E. L. Zicker, K. C. Berger, and A. D. Hasler. Limnol Oceanogr, Vol 1, No 4, pp 296-303, Oct 1956. 8 p, 5 tab, 27 ref.

Descriptors: *Phosphorus, *Mud-water interface, *Cycling nutrients, Lime, Mud, Solubility, Adsorption, Leaching, Nutrients, Wisconsin, Michigan, Lakes, Acid, Bottom sediments, Cores, Limnology. Lakes, Acid, bottom seuments, Croes, Limbougy. Identifiers: *Bog lakes, Phosphorus release, Lime treatment, Bog lake muds, Mud surface, Soluble phosphorus, Phosphorus suppression, Radioactive phosphorus, Nutrient-mud systems, Acidification of muds, Mechanical agitation.

Authors describe laboratory investigations concerning mud-water phosphorus relationship of some Northern Wisconsin and Upper Michigan bog lake muds as influenced by lime, acid, and mechanical agitation. Calcium carbonate added to water phase of mud-water systems reduced soluble phosphorus from 8.0 to 0.8 parts per billion. Lime formed thin crust at mud-water interface, while original pH of bottom material prevailed at 1/4 in. below mud surface. Agitating mud cores by stirring

Field 02-WATER CYCLE

Group 2K—Chemical Processes

resulted in complete lime penetration throughout a resulted in complete time penetration throughout a 3-in. core. Experimental apparatus for obtaining a 12 deg C temperature differential for stratifying water is described. Radioactive ordinary superphosphate fertilizer was placed at various depths below mud surface. Percentage as well as depths below mud surface. Fercentage as well as amount of phosphorus released to water was very small with virtually no phosphorus released below 1/4 in. under mud surface. Mud agitation resulted in approximately twice the concentrations of soluble phosphorus in the water phase of agitated systems compared to undisturbed systems. Most effective means of releasing fertilizer phosphorus 1/4 in. below mud surface was acidification of previin. below mud surface was acidification of previously limed mud-water systems. Mechanism of phosphorus suppression by adding calcium compounds to mud-water systems, authors suggest, is adsorption of phosphate ions onto surface of calcium particles. (Eichhorn-Wisc)
W69-03363

PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER, Copenhagen Univ., (Denmark). Dept. of Plant Sigurd Olsen.

Verh Int Ver Limnol, Vol XV, pp 333-341, Feb 1964. 9 p, 7 fig, 2 ref.

*Sediments, *E *Sediment-water *Eutrophication, *Phosphates, interfaces *Cycling nutrients, Phosphorus, Oxidation, Mud, Sorption, Adsorption, Equilibrium, Sediment discharge, Lakes, Radioisotopes, Oxidation-reduction potential.

Identifiers: Phosphorus exchange, Lake Fureso (Denmark), Stagnation.

The effect of increasing amounts of phosphate, labeled with P-32, on the adsorption to and the exchange by the sediment has been investigated; exchange by the sediment has been investigated; time and temperature have been constants. Phosphate adsorption and exchange for a reduced and oxidized coarse sediment and finely grained sediment from Lake Fureso are indicated. The descriptions for the exchanged and adsorbed phosphates for the sediment in reduced state follow the same equation as for the oxidized sediment but with constants of different values. In the reduced state this sediment will exchange and absorb less phosphate than in the oxidized state for the same phosphate than in the oxidized state for the same sediment. In transferring these results for this sediment to normal lake conditions, one may expect not to find any phosphate adsorption to a sediment of this type during stagnation periods but only phosphate exchange and phosphate release. Descriptions of the apparatus used to conduct experiments are included. (Eichhorn-Wisc) W69-03365

ACETYLENE REDUCTION BY NITROGEN-

FIXING BLUE-GREEN ALGAE,
Wisconsin Univ., Madison. Dept. of Biochemistry;
and Wisconsin Univ., Madison. Water Chemistry

Lao. W. D. P. Stewart, G. P. Fitzgerald, and R. H. Burris. Arch Mikrobiol, Vol 62, pp 336-348, 1968. 13 p, 2 fig, 7 tab, 27 ref.

Descriptors: *Cyanophyta, *Nitrogen fixation, *Phytoplankton, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Bioassay, Chlorophyta, Cycling nutrients, Environmental effects, essential nutrients, Light, Light penetration, Limnology, Nitrogen compounds, Nutrient requirements, Ammonium compounds, Physiological ecology.

Known nitrogen-fixing species of blue-green algae are capable of reducing acetylene to ethylene, but acetylene is not reduced by Anacystis nidulans, which does not fix nitrogen. Cycad root nodules which contain blue-green algae as endophytes reduce acetylene. Acetylene reduction is inhibited by carbon monoxide. Nitrate- or ammonium-nitrogen has no immediate effect on algae-reducing acetylene, but algae grown on nitrate-nitrogen

gradually lose their capacity to reduce acetylene. Nitrate-nitrogen also inhibits heterocyst formation in these algae, and there is a fairly direct correlation between the abundance of heterocysts in a particular sample and its capacity to reduce acetylene. Aphanizomenon flos-aquae reduces acetylene and fixes nitrogen in unialgal culture, and there is the three reductions. strong presumptive evidence that these reductions are carried out by the alga rather than by associated bacteria. The molar ratios of ethylene: ammonia produced vary within the range 1.4-1.8. (Eichhorn-Wisc)
W69-03368

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION

USING THE ACETYLENE REDUCTION TECHNIQUE, Wisconsin Univ., Madison. Dept. of Biochemistry; and Wisconsin Univ., Madison. Water Chemistry

W. D. P. Stewart, G. P. Fitzgerald, and R. H. Burris. Proc Nat Acad Sci, Vol 58, No 5, pp 2071-2078, Nov 1967. 8 p, 8 fig, 6 tab, 19 ref.

Descriptors: *Cyanophyta, *Nitrogen fixation, *Phytoplankton, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Bioassay, Chlorophyta, Diatoms, Cycling nutrients, Environmental effects, Essential nutrients, Light, Light Penetration, Limnology, Nitrogen compounds, Nutrient requirements, Ammonium compounds, Physiological ecology.

The reduction of acetylene can be employed as an index of nitrogen-fixation in situ in aquatic environ-ments, in soils, and by nodulated plants. Ethylene produced from acetylene could be measured gaschromatographically after 5 seconds to 30 minutes of exposure of nitrogen-fixing agents to acetylene. In lakes and soils, reduction was correlated directly with the abundance of heterocystous blue-green al-gae. Ten replicate 1 ml samples of a bloom of Gloeotrichia echinulata from Lake Mendota, Wis, had ethylene production between 1.32 and 2.08 had ethylene production between 1.32 and 2.08 millimicromoles of ethylene per militgram of protein per minute. Details of daily variations in in situ acetylene reduction, the effect of light on reduction, and depth of sample collected in Lake Mendota are presented. As few as 2 gloeotrichia or 4 aphanizomenon flos-aqua colonies would give measureable rates of acetylene reduction within 30 minutes. Acetylene reduction by alnus, comptonia and southern was characteristic of the root podules. and soybean was characteristic of the root nodules only. (Eichhorn-Wisc)
W69-03372

NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING,

Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05B.

For abstract, see . W69-03400

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES, Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg. For primary bibliographic entry see Field 05B. For abstract, see . W69-03402

PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN

OF GROUND WAS ALL RUSSIAN), Hydro-Chemical Inst., Novocherkassk (USSR). Ye V. Posokhov. Leningrad, USSR, Hydrometeorological House, 1966. 256 p, 13 fig, 9 tab, 455 ref.

Descriptors: *Groundwater, *Mineral water, *Water types, *Water chemistry, Hydrogeology, Aquatic microbiology, Chemical analysis, Geochemistry, Water temperature, Geologic con-

trol, Groundwater movement, Groundwater recharge, Gravitational water, Topography, Climate, Precipitation (Atmospheric).
Identifiers: Groundwater chemical composition.

This monograph reviews in detail the numerous (455) publications in the USSR and abroad and the (455) publications in the USSR and abroad and the author's many investigations about the hydrochemical aspects of groundwater. Because knowledge of the factors influencing occurrence of minerals in water are needed in the search for suitable supplies for drinking, industrial and agricultural uses, an analysis was made of the factors responsible for mineralization and chemical composition of groundwaters. The book consists of the following chapters: (1) historical summary of the development of the concept of processes and factors responsible for the chemical composition of groundwaters; (2) chemical classification of groundwaters; (2) chemical classification of groundwaters and related factors; (3) physico-geographical factors; (4) geological factors; (5) hydrogeological factors; (6) physico-chemical factors; (7) physical factors; and (8) biological factors. (Gabriel-USGS) W69-03533

THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS, International Atomic Energy Agency, Vienna

B. R. Payne, and L. L. Thatcher.

For 8-volume Proceedings, see this issue, Field 06B, W69-03305. Int Conf on Water for Peace, Wash, D. C., Vol 4, pp 320-331, 1967. 12 p, 4 fig, 1

Descriptors: *Chemistry of precipitation, *Water chemistry, *Tritium, Fallout, Nuclear explosions, Tracers, Monitoring, Networks, Data collections. Identifiers: *Hydrogen isotopes, *Oxygen isotopes, Tritium distribution

The international project for measuring the concentration of hydrogen and oxygen isotopes in precipitation which was launched by IAEA and WMO in 1960, provides information on the occurrence of these isotopes at over 100 stations throughout the world. The tritium data provide the base for interpretation of the tritium content of natural waters in studying hydrological problems. Environmental tritium is derived from two sources. The first is due to production by cosmic rays and the second is the production by the detonation of thermonuclear devices, which since 1954 has dwarfed cosmic ray production of tritium. The data obtained from this world network have established certain regularities in the pattern of tritium distribution in area and time which may be used to reconstruct by correlation the history of tritium concentrations in precipitation at a given site, provided that the site is climatologically related to the network stations and is not subject to significant climatic disturbances of local origin. The general pattern of distribution of tritium in both the northern and the southern hemisphere is discussed northern and the southern hemisphere is discussed together with examples of the tritium history of the key stations which have the longest record. The results of this project are discussed in relation to their use in hydrological studies in different parts of the world. W69-03555

EVALUATION OF ORGANIC COLOR AND IRON IN NATURAL SURFACE WATERS, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 03E. For abstract, see .

W69-03558

2L. Estuaries

COMPUTATION OF SEICHE VELOCITIES IN BODIES OF WATER WITH A COMPLEX BOT-

TOM RELIEF,
For primary bibliographic entry see Field 02H.
For abstract, see.

W69-03217

SEDIMENTATION IN A MEANDERING ESTUA-

RY, Lehigh Univ., Bethelem, Pa. Marine Science Center; Georgia Univ., Sapelo Island, Ga., Marine Inst.; and Georgia Univ., Athens. Dept. of Geology. For primary bibliographic entry see Field 02J. For abstract, see . W69-03228

HYDROLOGIC DATA COLLECTION IN TIDAL **ESTUARIES**,

Federal Water Pollution Control Administration, Cincinnati, Ohio.

Charles G. Gunnerson.
Water Resources Res, Vol 3, No 2, pp 491-504, 1967. 14 p, 12 fig, 4 tab, 8 ref.

Descriptors: *Estuaries, *Sampling, *Water pollution, *Path of pollutants, *Prediction, Frequency analysis, Regression analysis, Time series analysis Hydrologic data, Mathematical studies, Statistical

Identifiers: Spectral analysis, Potamac River, Raritan Bay, Sacramento River.

For predictive models, the optimum sampling interval and record length depend upon the frequencies at which significant variance is found. Estimates of spectral density, coherence, and phase relation-ships of stage, velocity, and salinity provide a basis for evaluating hydrologic data collection and utilization near the mouth of the Sacramento River. Here it was found that a 2-hr sampling interval provided the essential data for engineering purposes. This interval is consistent with those found for the Potomac River estuary and for Raritan Bay. (Knapp-USGS) W69-03239

THE DISTRIBUTION OF EXCESS TEMPERA-TURE FROM A HEATED DISCHARGE IN AN ESTUARY,

John Hopkins Univ., Baltimore, Md. Chesapeake

Bay Inst. H. H. Carter.

Work done for AEC and Maryland Univ, Natural Res Inst. Chesapeake Bay Inst Tech Rep No 44, Oct 1968. 39 p, 18 fig, 4 ref. AT (30-1) 3109.

Descriptors: *Water temperature, *Estuaries, *Thermal powerplants, Heated water, Mixing, Tides, Movement, Tracers, Dye releases. Identifiers: Patuxent River (Maryland).

A dye tracer and temperature distribution study A dye tracer and temperature distribution study was run in the Patuxent estuary, Maryland, to determine the effect of powerplant heat discharges on water temperatures. Temperatures were taken at 5 sections upstream and 5 sections downstream from the discharge canal. At each section 3 time-temperature relations were compiled and shown graphically. The theoretical temperature distribution in time and space is discussed, and the measured results compare reasonably well with predictions. The tracer study was unsuccessful because of high chlorine residuals in the condenser discharge water. (Knapp-USGS) W69-03341

SEA WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE ACTION, Agricultural Research Service, Fresno, Calif. Soil and Water Conservation Research Div. Kenneth L. Dyer, and Jerold J. Behnke. J Hydrol, Vol 6, No 1, pp 95-101, Jan 1968. 7 p, 3 for 7 cef.

Descriptors: *Saline water intrusion, *Fresh water, *Waves (Water), *Forebays, Water quality, Flow, Underflow, Sea water.
Identifiers: *Fresh-water forebay, *Salinas River Lagoon (California).

The adverse effect of sea water on water quality of the Salinas River Lagoon near Castroville, Califor-nia, was investigated. Bench levels indicated that the forebay is above mean sea level; however, additional investigations showed that wave action maintains a water level beneath the beach, which is above mean sea level and forebay. Tides, wave action, and density differences between fresh and salt water should be considered in the interpretation of hydraulic relationships between coastal lagoons and the sea. Wave action produces a net landward gradient resulting in underflow from the sea into the forebay. The quantity of sea water added to the lagoon was calculated from salt balance and from gradient-transmissibility relationships. The amount of sea water underflow calculated by these two independent methods was 24.5 and 25.1 acre-ft respectively. (Llaverias-USGS) W69-03531

THE POTOMAC ESTUARY - STATISTICS AND

PROJECTIONS,
For primary bibliographic entry see Field 05B. For abstract, see . W69-03603

'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES, Federal Water Pollution Control Administration,

Atlanta, Ga.

For primary bibliographic entry see Field 05B. For abstract, see . W69-03605

A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES,

For primary bibliographic entry see Field 06G. For abstract, see . W69-03607

'DISTRIBUTION POLLUTIONAL LOADINGS IN SUISUN BAY',

Stanford Univ., Calif.
For primary bibliographic entry see Field 05B.
For abstract, see . W69-03609

'ESTUARINE OXYGEN RESOUR PHOTOSYNTHESIS AND REAERATION', **RESOURCES-**

Stanford Univ., Stanford, California. For primary bibliographic entry see Field 05G. For abstract, see . W69-03610

COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF

For primary bibliographic entry see Field 06B. For abstract, see .
W69-03624

CHESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL, NAVIGATION, EROSION, FISHERIES-MINUTES OF THE FIRST MEET-

For primary bibliographic entry see Field 06B. For abstract, see . W69-03626

'MIXING OF COLUMBIA RIVER AND OCEAN

WATERS, SUMMER', Stanford Univ., Calif. For primary bibliographic entry see Field 05C. For abstract, see . W69-03632

TIDAL MARSH - CONFLICTS AND INTERAC-

TIONS, Franklin C. Daiber. Estuarine Bulletin, Vol 3, No 1, March, 1968, pp 4-

Descriptors: *Competing uses, *Salt marshes, *Delaware, *Ecology, Efficiencies, Marshes, Wetlands, Balance of nature, Biochemistry, Coastal marshes, Hydrography, Hydrologic aspests, Geo-graphical regions, Regions, Northeast U. S., Fishe-ries, Invertebrates, Animals, Detritus, Plankton, Aquatic life, Zoo-plankton, Aquatic animals, Vegetation, Atlantic coastal plain, Coastal plains, Water utilization.

Salt marshes play an important role in the biotic economy of coastal waters. Because of conflicting uses their productivity has been reduced. Graduate students of the University of Delaware conducted an ecological study of Canary Creek marsh to attempt to answer some of the local problems in Delaware. Topics studied were: hydrographic fea-tures, biochemical activity, plant production, quan-tities of detritus, zooplankton, estimation of the numbers of some of the non-planktonic invertebrates, and evaluation of the fisheries. The ecological cycle in the marsh was described. W69-03641

THE DELTA PROJECT.

Report, Information Department of Ministry of Transport and Public Works, The Hague, Netherlands, March, 1967.

Descriptors: *Shore protection, *Saline water intrusion, *Foreign countries, *Agricultural engineering, Coastal engineering, Dam construction, Erosion, Engineering, Construction, Geographical regions, Regions.

The Delta Project has two objectives: (1) to considerably shorten and strengthen the total length of coast and dykes washed by the sea; (2) to combat the salination of the Dutch reaches of the rivers and adjoining channels and so increase agricultural production. Land reclamation is not the purpose of the project; very little, if any, will be gained. Wing methods and new techniques are discussed. W69-03646

'STATEMENT',Federal Water Pollution Control Administration,

Miller A. Dial.

In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 37-38.

Descriptors: *Georgia, *Sedimentation, *Soil conservation, *Runoff, *Soil erosion, Rivers, Cultivated lands, Sediment control, Erosion, Consertryated lands, Sediment control, Erosion, Conservation, Silting, Structures, Landfills, Control, Legislation, Regulation, Water pollution control, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Urbanization, Dikes, Earthworks, Embankments, Engineering structures, Hydraulic structures.

There are several causes of pollution which fall under the jurisdiction of the Georgia State Soil Conservation Act. Among these are: erosion of agricultural lands (contributing to silting of estuarine areas), siltation of river waters by highway rights-of-way and urban developments, and nutrient enrichment in estuaries, presumably from agricultural runoff. Under the protection of this act these kinds of pollution have been somewhat curtailed. Other practices such as landfill and diking are also controlled by this Act. W69-03647 ere are several causes of pollution which fall

ENVIRONMENTAL FACTORS IN COASTAL AND ESTUARINE WATERS: BIBLIOGRAPHIC SERIES - VOLUME II. COAST OF WASHING-TON,

George R. Ditsworth.
Report, Federal Water Pollution Control Administration, Northwest Region, Pacific Northwest Water Laboratory, Corvallis, Oregon, August,

Field 02-WATER CYCLE

Group 2L—Estuaries

Descriptors: *Bibliographies, *Estuarine environment, *Washington, Aquatic environment, Environment, Geographical regions, Regions, Pacific coast region, Pacific northwest U. S., Water pollution. Aquatic life.

Indexed herein are references to literature pertaining to the marine waters of the State of Washington. References to these papers, most of which have been published since 1955, are indexed under one or more of the following headings: Marine Biology, Fisheries, Geology, Chemical and Physical Oceanography, Water Pollution, and Bibliographies, Literature Surveys, and Compilations. W69-03651

ESTUARIES: IRREPLACEABLE ENVIRON-

For primary bibliographic entry see Field 06B. For abstract, see . W69-03662

FEDERAL COURT DECISION JEOPARDIZES CURRENT EFFORTS TO SAFEGUARD NATION'S ESTUARIES.

Conservation Foundation Letter, April 22, 1968,

Descriptors: *Dredging, *Judicial decisions, Legal aspects, Land reclamation, Navigation.

The article discusses the possible implications and repercussions of a Supreme Court decision denying the right to the Corps of Engineers of considering effects on natural resources when a dredging and filling permit is to be processed. The Corps of Engineers can deny permits only for reasons of impeding navigation.

THE HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF FLOW AND WATER-QUALITY CHARACTERISTICS, G. L. Giese, and J. W. Bart.

New York Conservation Department, Nesources Commission, Bulletin No 61, 1967. Water

Descriptors: *Water quality, *Flow, *Hudson river, *New York, Hydrologic aspects, Tidal waters, Bodies of water, Rivers, Running waters, Streams, Surface waters, Appalachian Mountain region, Geographical regions, Great Lakes region, Northeast U. S., Regions.

This report outlines the present level of knowledge of flow and water quality characteristics in the Hudson river estuary. W69-03668

'STATEMENT', Federal Water Pollution Control Administration,

Auanta, Oa.

David H. G. Gould.

In CLEAN WATER FOR THE NATION'S

ESTUARIES, Proceedings of the Georgia Public

Meeting, Jekyll Island, Georgia, February 29,

1968, pp 62-69.

Descriptors: *Economic impact, *Commercial fishing, *Recreation, *Georgia, *Commercial shellfish, Sport fishing, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish, Mollusks, Marine animals, Benthos, Benthic fauna, Oysters, Clams, Fishing, Industries, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Water sports, Shrimp, Crustaceans.

Georgia has 2344 miles of tidal shoreline with a larger estuarine area than any other state. The production of food for man and animal is twice that of the best farmland and 20 times that of the open sea. The estuaries support Georgia's commercial fisheries. Here are some statistics: (1) Average wholesale value of landings and manufactured product - \$25 million. (2) Number of manufactur-

ing plants - 57. (3) Number of employees of manufacturing plants - 2000. (4) Amount of commercial landings of fish and shellfish in 1965 - 20 million landings of fish and shellfish in 1965 - 20 million pounds. (5) Dockside value of commercial landings of fish and shellfish - \$4,100,000. (6) The catch by species is: (a) Shrimp - 8,589,000 pounds. (b) Blue crabs - 10,215,000 pounds. (c) Oyster meals - 248,000 pounds. (d) Roe shad - 350,000 pounds. (e) Miscellaneous edible fish - 300,000 pounds. (e) Miscellaneous edible fish - 300,000 pounds. Recreation is also a significant factor in the economy of the Georgia coastal area. In 1960 approximately 167,000 persons participated in sport fishing, spending an average of \$80 each. W69-03671

'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION EQUATION', Stanford Univ., Calif.

Donald R. F. Harleman, Chok-hung Lee, and Lawrence C. Hall.

In PROCEEDINGS OF THE NATIONAL SYM-POSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 586-611.

Descriptors: *Mathematical models, *Tidal effects, *Fresh water, *Dispersion, Mathematical studies, Model studies, Water types, Flow profiles.

The purpose of this paper is to develop a mathematical model which accurately describes the advective (horizontal) motion (including the tidal and fresh water flow) and the longitudinal dispersion term for a variable estuary of arbitrary geometry. This extends previous studies which have assumed that the advective term is due solely to the fresh water discharge and which have ignored advection due to the tidal motion in an estuary. The model developed requires numerical solution procedures.
W69-03675

'ASPECTS OF THE ESTUARINE ECOSYSTEM', National Security Industrial Association, Washing-

For primary bibliographic entry see Field 06G. For abstract, see . W69-03677

'FINITE-DIFFERENCE MODELLING RIVER AND ESTUARY POLLUTION', Stanford Univ., Calif.
For primary bibliographic entry see Field 05A. For abstract, see . W69-03690

'STATEMENT', Federal Water Pollution Control Administration, Atlanta, Ga.

Atlanta, t.a.
C.E. Kindsvater.
In CLEAN WATER FOR THE NATION'S
ESTUARIES, Proceedings of the Georgia Public
Meeting, Jekyll Island, Georgia, February 29,
1968, pp 39-42.

Descriptors: *Resource development, *Estuarine environment, *Ecology, Water resources development, Resources development, Water pollution control, Control, Water pollution effects, Water pollution sources, Hydrologic aspects, Geologic investigations, Biocontrol, Control, Chemcontrol, Social needs.

Since there is much to be learned about the unique problems of an estuarine resources management program, a large part of such a program must consist of research. Estuarine development may be divided into the following research areas: (1) hydrologic, hydraulic, and geologic factors involved in the development of the physical characteristics; (2) biologic and chemical factors, which influence the physical as well as their ecological characteristics; (3) specific man-made pollutional factors and effects; and (4) socioeconomic and institutional factors resulting from man's occupance of estuarine regions and his utilization of their resources. Since there is much to be learned about the unique

W60-03606

03. WATER SUPPLY **AUGMENTATION** AND CONSERVATION

3A. Saline Water Conversion

DESALINATION AND ITS ROLE IN WATER SUPPLY.

British Information Service, London (England).

London, England, Headley Brothers Ltd Pub Co, 1967. 103p, 7 fig, 3 append.

Descriptors: *Desalination, *Thermal powerplants, *Nuclear powerplants, Water sources, Water supply, Water utilization, Research and develop-

Identifiers: United Kingdom Atomic Energy Authority.

The use of desalination for water supply in Great Britain and elsewhere by British technology is surveyed. The topics covered in detail are availability of water, traditional methods of water supply and irrigation, British achievements in water supply and irrigation, desalination and other new sources, desalination methods, British achievements in desalination and desalination research and development. Particular attention is given to using the waste heat of electric power generation for desalination, thus solving a water supply and a water pollution problem with the same process. (K-napp-USGS)
W69-03351

THE LAKE TAHOE WATER RECLAMATION

For primary bibliographic entry see Field 05D. For abstract, see . W69-03640

ENGINEERING AND ECONOMIC FEASIBILITY STUDY FOR A COMBINATION NUCLEAR POWER-DESALTING PLANT.

Report, Bechtel Corporation, San Francisco, California, January, 1966.

Descriptors: *Desalination, *Economic feasibility, *Nuclear powerplants, *Electric power production, *California, *Water costs, Forecasting, Demineralization, Costs, Geographical regions, Pacifical Productions, Costs, Geographical Regions, Costs, Cost Pacific coast regions, Regions, Separation techniques, Water purification, Water treatment, reasibility, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Electric power, Southwest U. S.

This report presents results of a study to determine the feasibility of a dual purpose electric-power generation and desalting plant for the Metropolitan Water District of Southern California. The study concludes that 150 million gallons per day of desalted water can be produced by 1971 at a site cost (undelivered) of 21.9 cents/thousand gallons. A critical analysis of this report has been made by A critical analysis of this report has been made by Milliman. Reference to the Milliman publication also appears in this report bibliography. W69-03658

3B. Water Yield Improvement

GROUND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON, Geological Survey, Washington, D. C. For primary bibliographic entry see Field 02F. For abstract, see . W69-03224

INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.

For primary bibliographic entry see Field 06B. For abstract, see. W69-03305

THE CONTINENTAL USE OF ARCTIC-FLOW-ING RIVERS.

Washington State Univ., Pullman; Washington Water Research Center, Pullman; and Washington Univ., Seattle

For primary bibliographic entry see Field 04A. For abstract, see .

W69-03313

THE INFLUENCE OF RAINFALL INTERCEP-TION ON STREAMFLOW,

Southeastern Forest Experiment Station, Franklin.

For primary bibliographic entry see Field 021. For abstract, see . W69-03384

EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON EVAPOTRANSPIRATION, Southeastern Forest Experiment Station, Franklin,

N.C.

For primary bibliographic entry see Field 02D. For abstract, see.

W69-03386

FOREST TREATMENT EFFECTS ON WATER

Southeastern Forest Experiment Station, Franklin, NC

A. R. Hibbert.

Reprint from Proc. Int. Symp. Forest Hydrol., Penn State Univ 1965, 527-543, Pergamon Press, Inc.

Descriptors: *Evapotranspiration, *Vegetation effects, *Water yield improvement, Water yield, *Watershed management, Forest management, Reforestation, Hydrologic aspects.
Identifiers: *Forest treatments, *Experimental watersheds, Logging (Forest).

Results are reported for thirty-nine studies of the Results are reported for thirty-nine studies of the effect of altering forest cover on water yield. Taken collectively, these studies reveal that forest reduction increases water yield, and that reforestation decreases water yield. Results of individual treatments vary widely and for the most part are unpredictable. First-year response to complete forest reduction varies from 34 mm to more than 450 mm of increased streamflow. A practical unper limit of of increased streamflow. A practical upper limit of yield increase appears to be about 4.5 mm per year for each percent reduction in forest cover, but most treatments produce less than half this amount. There is strong evidence that in well-watered regions, at least, streamflow response is proportional to reduction in forest cover. As the forest regrows following treatment, increases in streamflow decline; the rate of decline varies between catchments, but appears to be related to the rate of forest recovery. Seasonal distribution of streamflow response to treatment is variable; response in streamflow may be almost immediate or considerably delayed depending on climate soils. siderably delayed, depending on climate, soils, topography, and other factors.

W69-03387

FACTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO PRECIPITATION IN HUMID AREAS,

Southeastern Forest Experiment Station, Franklin,

For primary bibliographic entry see Field 02E. For abstract, see . W69-03388

INTERCEPTION BY EASTERN WHITE PINE, Southeastern Forest Experiment Station, Franklin, For primary bibliographic entry see Field 02I. For abstract, see. W69-03391

TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,

Southeastern Forest Experiment Station, Franklin, N. C.; and Connecticut Agricultural Experiment Station, New Haven.

For primary bibliographic entry see Field 02D. For abstract, see . W69-03396

3C. Use of Water of Impaired Quality

A STATISTICAL STUDY OF SOME INDICES OF SALINE WATER IRRIGATED SOILS OF RAJASTHAN,

Udaipur Univ. (India). Agricultural Experiment

K. V. Paliwal, and G. L. Maliwal.

Ann of Arid Zone, Vol 7, No 1, pp 127-131, March 1968. 5 p, 2 tab.

Descriptors: *Statistics, *Saline water, *Irrigation effects, Arid lands, Irrigated land, *Salts, Sodium, effects, Arid lands, Irrigated land, *Salts, Sodium, Electrical conductance, Hydrogen ion concentration, Alkaline soils, Gypsum, Cation exchange, Adsorption, *Soil chemical properties, Sampling, Conductivity.

Identifiers: Rajasthan (India).

Surface soil samples irrigated with saline water in Surface soil samples infigured with same water in Rajasthan, India, were examined to determine the interrelationship between pH, exchangeable sodi-um percentage, sodium adsorption ratio, gypsum requirement, electrical conductivity, and total salt concentration of the saturation extract. The results obtained were discussed in light of results reported by other workers. Electrical conductivity was found to be highly correlated with total soluble salts from the saturation extract. Correlation between the other factors, although statistically sigorificant, was of low order. A knowledge of salt con-centration of the upper surface soils irrigated with saline water is exceedingly important in adopting cultural practices, selecting suitable crop species, and in taking reclamation measures in arid lands. (Affleck-Ariz) W69-03482

EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION OF BAJRA (PENNISETUM TYPHOIDES),

Udaipur Univ. (India). Agricultural Experiment

Ram Deo, B. L. Baser, and D. V. S. Ruhal. Ann of Arid Zone, Vol 7, No 1, pp 100-104, March 1968. 5 p, 1 tab.

Descriptors: *Sodium, Saline salts, *Salts, Salt tolerance, Nutrients, Alkaline soils, Crop response, Ions, Uptake, *Plant growth, Chlorides, Carbonates, Toxicity, Identifiers: Rajasthan (India), Dry matter, *Bajra.

Bajra is the most important crop of Rajasthan, In-Bajra is the most important crop of Rajasthan, India, and is grown in regions of the state where soils are saline and alkaline. A pot experiment was conducted to determine the effect of sodium salts on dry matter production and uptake of nutrients (N, P, Ca, Mn, and Fe) by Bajra. The toxic effect of carbonate ions was always greater than the chloride and bicarbonate ions. Sulphate ions decreased growth to a lesser extent. Total uptake of nitrogen, phosphorus, and calcium decreased with increased phosphorus, and calcium decreased with increased concentrations of chloride, bicarbonate, and carbonate ions. Calcium content of the plant decreased as concentration of chloride, bicarbonate and carbonate ions increased, and was affected to the greatest extent by the chloride ions. At the higher concentrations of bicarbonate ions both iron and manganese decreased. (Affleck-Ariz) W69-03483

3E. Conservation in Industry

EVALUATION OF ORGANIC COLOR AND IRON IN NATURAL SURFACE WATERS,

Geological Survey, Menlo Park, Calif.

William L. Lamar. Geol Surv Res 1968, Prof Pap 600-D, pp D24-D29, 1968. 6 p, 3 fig, 2 tab, 12 ref.

Descriptors: *Surface waters, *Color, Organic acids, Iron, Colloids, Hydrogen ion concentration, Chelation.

Identifiers: Unsaturated organic compounds, Colloidal sols, Metallo-organic interactions.

Examination of organic color in natural surface waters revealed similarities in the complex color macromolecules extracted with n-butanol from stream waters in areas having pronounced dif-ferences in climatic conditions. The organic matter in the colored waters consists primarily of complex polymeric hydroxy carboxylic acids. Aromatic un-saturation also was observed. The infrared spectra of the predominant part of the organic matter were independent of the color intensity, pH, and mineral content of the water as well as the geographical location. Variable quantities of iron unrelated to the concentration and source of the organic matter are held in apparent solution by the complex organic acids. Preliminary results suggest that iron, probably as ferric hydroxide or oxide, forms colloidal sols with the organic matter. The sols vary considerably in particle size, and a relationship between particle size, pH, and iron concentration is indicated. (USGS) W69-03558

THE ROLE OF INDUSTRIAL PROCESS CHANGES IN AFFECTING WATER REQUIRE-MENTS,

Washington, State Univ., Pullman. Bureau of Economic and Business Research. For primary bibliographic entry see Field 06D. For abstract, see . W69-03599

3F. Conservation in Agriculture

WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,

Tennessee Dept. of Conservation, Nashville. Div. of Water Resources.

For primary bibliographic entry see Field 06D. For abstract, see .

WATER UTILIZATION IN GREENHOUSES: ALTERNATIVES FOR AGRICULTURE IN ARID

REGIONS, Colorado State Univ., Fort Collins, Dept. of Horticulture

Joe E. Hanan.

Proc Annual Amer Water Resources Conf, pp 160-169, 1967. 10 p, 3 tab, 2 fig, 41 ref.

Descriptors: *Water utilization, *Arid lands, *Greenhouses, *Agriculture, Field crops, Crop production, Acreage, Evapotranspiration, Irrigation efficiency. Identifiers: Gross return.

Water utilization in greenhouses was discussed in an attempt to compare its advantages with field crop agriculture. Water utilization in greenhouses was high due to a variety of factors; however, production was greatly increased. An attempt to compare gross return and return per acre-foot showed where gross return acre super 1 exceeded \$1000 acre super 1, highly intensive crop production was in good position to compete for the water. (Affleck-Ariz) W69-03486

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

ECONOMIC VALUE OF IRRIGATION WATER, For primary bibliographic entry see Field 06B. For abstract, see . W69-03582

04. WATER QUANTITY MANAGEMENT AND

4A. Control of Water on THE Surface

MAGNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES,
Geological Survey, Washington, D. C.

For primary bibliographic entry see Field 02E. For abstract, see . W69-03225

DEPARTMENT OF NATURAL RESOURCES. For primary bibliographic entry see Field 06E. For abstract, see . W69-03255

POWERS OF THE DEPARTMENT OF PUBLIC WORKS AS TO PR PORT OF BOSTON HAR-

Mass Ann Laws, ch 91, secs 3, 4 (1967).

Descriptors: *Massachusetts, *Legislation, *Administrative agencies, *Harbors, Public lands, Shores, Tidal waters, Navigation, Piers, Railroads, State jurisdiction, Excavation, Transportation, Dredging, Industries, Ships, Beds, Water rights. Identifiers: Boston.

The Department of Public Works of the Commonwealth of Massachusetts has all the rights, powers, and duties (transferred to the directors of the port of Boston under previous statutes) in respect to lands, rights in lands, flats, shores, waters, and rights belonging to the commonwealth in tide waters and land under water in Boston harbor. It may excavate and dredge in Boston harbor wherever public convenience and necessity require. The department shall have charge of all commonwealth lands fronting the harbor and the construction of piers and other public works in the harbor. The department shall undertake such work for the impartners snan undertake such work for the improvement, development, maintenance, and protection of Boston harbor as it deems reasonable and proper. This includes modifications to railroads existing at the port. (Watson-Fla) W69-03259

DEVELOPMENT OF WATERFRONT FACILI-TIES - IMPROVEMENT AND PRESERVATION OF RIVERS, HARBORS, ETC. For primary bibliographic entry see Field 06E. For abstract, see . W69-03261

STRUCTURES THE DEPARTMENT OF PUBLIC WORKS MAY LICENSE TO BE ERECTED IN RIVERS AND STREAMS.
For primary bibliographic entry see Field 06E.
For abstract, see.

For abstract W69-03262

PUBLIC ACCESS TO GREAT PONDS.

Mass Ann Laws ch 91, sec 18A (1967).

Descriptors: *Massachusetts, *Easements, *Great ponds, *Right of way, Legislation, Administrative agencies, Public lands, Public rights, Access routes, Recreation, Cities, Water supply, Municipal water, Industrial plants.

Upon petition of ten citizens of the Commonwealth of Massachusetts that in their opinion public nece of Massachusetts that in their opinion public necessity requires a right of way to any great pond within the commonwealth, the Department of Public Works and the attorney general, or a representative designated by him, sitting jointly, shall hold a public hearing and receive all evidence presented. The joint board may make such additional integrations and if it appears. vestigation as it deems desirable, and if it appears to the board that a right of way already exists, it shall present a petition to the land court for registration of the easement. If it appears that no right of way exists, it shall submit a report, together with recommendations, to the general court on or be-fore January 1 of the following year. This section does not apply to any body of water used as sources does not apply to any body of water used as sources of water supply by the commonwealth or any town, district, or water company. Neither shall it affect or diminish any existing right to the use of the water of any pond for mercantile or manufacturing purposes. (Watson-Fla) W69-03265

STRUCTURES IN GREAT PONDS RESTRICTED - LOWERING WATERS REGU-LATED - SUPERVISION OF ERECTIONS -COMPENSATION FOR TIDE WATER DIS-PLACED,

Mass Ann Laws ch 91, secs 19-21 (1967).

Descriptors: *Massachusetts, *Legislation, *Great ponds, *Structures, Permits, Dams, Public lands, Administrative agencies, Construction, Pile driv-ing, Landfills, Encroachment, High water mark, Excavation, Tidal waters, Compensation, Industrial plants, Agriculture, Irrigation, Water supply, Insect

Generally in Massachusetts, by statute, no structure may be built or extended, piles driven, land ture may be built or extended, piles driven, land filled, or any other obstruction or encroachment made, in, over or upon the waters of any great pond below the natural high water mark. Any of the above encroachments may be made only after attaining a license from the Department of Public Works. A person authorized or licensed to make an encroachment of the waters of a great pond may lower the water level of that pond only after receiving the permission of the Department of Natural Resources. Furthermore, a person who has a license or authority to erect a structure, drive piles, or fill land in the waters controlled by the Departlicense or authority to erect a structure, drive piles, or fill land in the waters controlled by the Department of Public Works may not proceed to do so until he has submitted his plans to the department and received its approval. The amount of tide water displaced by any structure below the high water mark, or any filling of flats, shall be ascertained by the department, which shall require the persons who cause such displacement to make compensation therefor by excavating, under its direction, between the high and low water mark in some part of the same harbor, a basin for a quantity of water equal to that displaced. In lieu of excavation, a payment to the commonwealth of an amount assessed nient to the commonwealth of an amount asserby the department may be made. (Watson-Fla) W69-03266

ADDITIONAL COMPENSATION WHEN TITLE TO LAND IS IN THE COMMONWEALTH - UNAUTHORIZED ERECTIONS IN TIDE WATER TO BE PUBLIC NUISANCES, Mass Ann Laws ch 91, secs 22-28 (1967).

Descriptors: *Massachusetts, *Compensation, *Permits, *Encroachment, Legislation, Tidal waters, Public lands, Administrative agencies, Docks, Landfill, Construction, Excavation, Great ponds, Bridges, Highways, Banks, Rivers, High water mark, Harbors, Abatement, Structures, Pile driving, Cities, Connecticut, Financing, Hunting.

If authority or a license is granted by the general court or by the Department of Public Works of the Commonwealth of Massachusetts to a person to build a wharf or other structure upon, or to fill or otherwise occupy, land in tide water, or to build or extend any structure or drive piles, fill land or make

any obstruction, encroachment, or excavation in, over or upon the waters of any great pond, he shall, before the work is begun, pay to the commonwealth such compensation for the rights granted in any land, the title to which is in the commonwealth. any land, the title to which is in the commonwealth. The amount of compensation shall be determined by the governor and council. All money received from licenses and permits, displaced water, and rights in the commonwealth land received under this chapter goes into the general fund as ordinary revenue. Any unauthorized erection or one not conforming to the license in waters controlled by the department are deemed to be public nuisances. This chapter shall not legalize any structure, filling, the occurrence of the conforming to the received to the public nuisances. This chapter shall not legalize any structure, filling, or other occupation or encroachment, made without authority, upon the waters of any great pond prior to May 9, 1888 or in the Conn River below the high water mark prior to April 13, 1891. The powers and duties of the department relative to Province lands are also outlined. (Watson-Fla)

COUNTIES, CITIES, AND TOWNS MAY AP-PROPRIATE MONEY FOR IMPROVEMENT OF WATERWAYS.

Mass Ann Laws ch 91, secs 29-29A (1967).

*Administrative *Massachusetts. Descriptors: "Massachusetts, "Administrative agencies, *Construction, *Cities, Legislation, Tidal waters, Water law, Structures, Banks, Rivers, Financing, Harbors, Streams, Intertidal areas, Shores, Beaches, Damages, Easements.

A county or town of the Commonwealth of Mass may appropriate money for the improvement of tidal and non-tidal rivers and streams, harbors, tide waters, foreshores, and shores along a public beach within its jurisdiction, or for the construction of structures for the protection of private property along shores within its boundaries. Money so appropriated is paid to the state treasurer and expended by the Department of Public Works for such purposes within the limits of the county or town. The county or town assumes liability for all damages to property by reason of any taking of land, or of any right, interest, or easement in the land, within the county or town by the department for the project. (Watson-Fla)

PROHIBITION OF REMOVAL OF GRAVEL, ETC, FROM BEACHES REMOVAL OF NATU-RAL BARRIERS FROM EROSION BY THE SEA PENALIZED.

Mass Ann Laws ch 91, secs 30, 30A (1967).

Descriptors: *Massachusetts, *Tidal waters, *Shores, *Beaches, Legislation, Administrative agencies, Water law, Banks, Rivers, Harbors, Navigable waters, Gravel, Sands, Sand bars, Islands, Trees, Shrubs, Grasses, Vegetation, Oceans, Erosion, Cities.

The Department of Public Works of the Commonwealth of Massachusetts is empowered to prohibit, by written notice, the digging or removal of stones, gravel, sand, or other material or the destruction of any trees, shrubs, grass, or other vegetation on any beach, shore, bluff, headland, island, or bar in or bordering on tide waters if it appears that the removal or destruction is injurious to any harbor or other navigable tide waters. The removal of stones, gravel, sand, or other material from any natural barrier which protects the adjacent upland against erosion by the sea is prohibited. (Watson-Fla)

LEAKE V RICHARDSON (TITLE TO PONDS BY ADVERSE POSSESSION AND PRESCRIP-TION),

199 Va 967, 103 SE 2d 227-240 (1958).

Descriptors: *Virginia, *Ownership of beds, *Prescriptive rights, Boundary disputes, Judicial decisions, Beds, Riparian land, Riparian waters, Ponds, Lakes, Fishing, Riparian rights, Lakebeds,

Identifiers: *Adverse possession.

Plaintiff filed suit to quiet title, and alleged that she and her predecessors in title acquired title to a small pond by adverse possession, and that she also acquired exclusive fishing rights in the pond by prescription. The court stated that where ownership of a fresh water pond or stream surrounded by lands of different persons, whose titles as riparian owners include the land under the water to such pond or stream, is claimed by adverse possession, the acts of ownership must indicate a change of condition, showing a notorious claim of title, accompanied by the essential elements of adverse possession. The acts relied on must show actual, hostile, exclusive and continuous possession for the statutory period, and must be of such notoriety that the actual owner either has knowledge or may be the actual owner either has knowledge or may be presumed to know of the adverse claim. These same acts are necessary to obtain exclusive fishing rights by prescription. The court found that the rights asserted by the plaintiff were not necessarily anything more than the assertion of a right held in common; there was no change in the condition of the pond that affected the rights of the defendants. nor was there actual possession of the waters of the pond. The court held that the plaintiff's claims of title through adverse possession and exclusive fishing rights through prescription were unfounded. (Scott-Fla) W69-03279

RICE V STODDARD (DIRECTING RUNOFF TO DRAINAGE DITCH).

312 SW 2d 374-379 (Ct App Mo 1958).

Descriptors: *Missouri, *Drainage, *Ditches, *Levees, Drainage districts, Judicial decisions, Relative rights, Watercourses (Legal), Land reclamation, Laterals, Drains, Roads, Runoff, Surface

Plaintiff and defendant owned adjoining farms, both of which were part of the same drainage and reclamation district. A main drainage ditch ran along their eastern property line, and alongside the ditch ran a public road. Under the drainage district plan of reclamation dirt from the ditch was placed on the road, thereby raising its level and making into a layer. Other removes and distance led agrees into a levee. Other runways and ditches led surface accumulations to the main ditch. Defendant later built a levee on his own property that directed surface runoff into the main ditch. The defendant's levee ended within a few feet of the road-levee. Plaintiff sued for damages, claiming that defendant's private levee accumulated and unnaturally forced water from defendant's farm into, through and over the road and onto his farm. The court found that the roadway ditch into which defendant funneled water was already a drainage district watercourse. Under the applicable statute, any per-son was permitted to construct lateral ditches, on was permitted to construct lateral ditches, drains or levees for the purpose of draining water into any of the watercourses constructed by a drainage district. The court further held that the board of directors of the district acted within the scope of their powers when they cleaned out the main ditch and placed the dirt on the public roadway. (Scott-Fla) W69-03280

TOWN OF MIAMI SPRINGS V LAWRENCE (DAMAGES FROM FLOODING). 102 So 2d 143-147 (Fla 1958).

Descriptors: *Florida, Judicial decisions, *Overflow, Impoundments, Impounded waters, *Damages, Roads, *Obstruction to flow, Natural flow doctrine, Diversion, Legal aspects.

Plaintiff sued the defendant municipal corporation for damages allegedly resulting from the overflow and impounding of surface waters on plaintiffs' land, caused by a raising of the elevation of the street adjoining plaintiffs' property by the defendant. The court stated that liability could be imposed for damage caused by overflow resulting

from an artificial construction or obstruction, and a new action could be maintained for each successive overflow or flooding. The court found that the flooding constituted a 'continued wrong' against the plaintiff, and awarded temporary damages for past injuries. Since each flooding constituted a new cause of action, plaintiffs' suit was not barred by the statute of limitations. (Scott-Fla) W69-03284

BURAS ICE FACTORY, INC V DEPARTMENT OF HIGHWAYS (EASEMENTS TO CANALS). 235 La 158, 103 So 2d 74-84 (1957).

Descriptors: *Louisiana, *Easements, *Canals, Judicial decisions, Right-of-way, Roads, Navigation, Eminent domain, Legal aspects.

Defendant, the state highway department, constructed a dirt embankment across a canal for sup-porting a paved road. This was done under a grant from the owner of the canal. The construction effectively prevented navigation to and from the head of the canal, where plaintiff owned and operated an ice business. Plaintiff brought suit for damages, asserting that the ice plant was rendered a total loss and the value of the lot was greatly depreciated. A prior owner of the canal had also owned the ice plant, and some time ago had sold the plant to the plaintiff's predecessor in title. An easement was granted at that time from the ice plant to the canal, said easement crossing other land owned by the vendor. The court held, however, that the servitude of passage through the canal by the plaintiff is of the discontinuous type, which can be granted only by title, needing for its exercise the act of man. The court held that the easement granted only a way of ingress and egress with respect to the ice factory and the canal's upper bank; it did not grant right to use the canal itself. The court also held that the facts did not establish that a public way had been created through dedica-tion to a public use, even though in some instances public ways may be created in such a manner. (Scott-Fla) W69-03286

LEHIGH VALLEY RR V THE RUSSELL NO 1 (LIABILITY FOR DAMAGE CAUSED BY SUB-MERGED PILINGS). 163 F Supp 459-463 (EDNY 1958).

Descriptors: *New York, Judicial decisions, United States, Ships, Damages, Canals, Piles, *Hazards, *Navigation, Bulkheads, Cities, *Admiralty, Legal

Identifiers: Towage, *Navigation obstruction.

The owner of the L V 476 brought this action for damages sustained by reason of the negligence of the Tug Russell No 1 while being towed by her. The City of New York has been impleaded with the claim being that the accident occurred because of the negligence of the city in failing to maintain the bulkhead and cribbing on its property in such condition as would prevent obstructions in and of the adjoining navigable waters. The court found that there was negligence in the operation of the tugboat in that the tugboat was operated outside the channel and close to the submerged pilings of an old city dock. The court also found the city negligent in failing to maintain its property so as not to be a hazard to navigation because submerged pilings were not removed. The city was held liable to the tugboat owner for the sum it was required to pay to the vessel owner for damages to the vessel and loss or damage to its cargo. (Scott-Fia) The owner of the L V 476 brought this action for Fla) W69-03287

DRAINAGE OF HIGHWAY.

N C Gen Stat sec 136-21--136-24 (1964).

Descriptors: *North Carolina, *Highways, *Drainage, *Cost allocation, Legislation, Excavation, Canals, Surplus water, Right-of-way, Benefits. *Highways,

Whenever it becomes necessary to drain any whenever it becomes necessary to drain any highway by excavating canals to carry the surplus water, and by such excavation, lands other than said highway will be benefited, procedures are established for apportioning the cost of excavation of such canal between the highway authorities and the benefited landowners. (Childs-Fla) W69-03288

HAYES V BOWMAN (RIPARIAN RIGHTS ON NAVIGABLE WATERS).

91 So 2d 795-803 (Fla 1957).

Descriptors: *Florida, *Ownership of beds, Peechpions: "Florida, "Ownership of beds, *Riparian rights, *Riparian land, Judicial deci-sions, Tidal waters, Navigation, Fishing, Swimming, Dredging, Bulkheads, Landfills, Channel, Riparian

Identifiers: *Unobstructed view.

This was a suit for a declaratory judgement involving alleged riparian rights of the parties in tidal waters of Boca Ciega Bay. Appellants contended that as upland owners of land bounded by navigable waters they enjoy certain common-law riparian rights to an unobstructed view of the Bay, as well as a right of ingress and egress to and from their land over the waters of the Bay to and from the channel. Except for statutory variations, the state holds title to lands under navigable tidal waters and the foreshore. As at common law, this title is held in fishing, bathing and similar uses. Such title is need in trust for the people for the purposes of navigation, fishing, bathing and similar uses. Such title is not held primarily for the purpose of sale. However, the State may dispose of submerged lands under tidal waters to the extent that the public right will not be infringed. Moreover, any person acquiring any such lands from the State must not interfere with the recognized common-law riparian rights of riparian owners, eg, unobstructed view, ingress and egress over the foreshore to and from the water. These riparian rights must be preserved over an area 'as near as practicable' in the direction of the channel so as to equitably distribute the submerged lands. Riparian rights do not extend over an area measured by lines at right angles to the channel, and the area cannot be defined with mathematical exactitude. The court affirmed the chancellor's ruling adverse to the appellants, noting, however, that if the appellees' proposed fill had blocked the view to the channel, the appellants might have had substantial grounds for complaint. (Childs-Fla) W69-03290

PAYNE V HAZARD COCA COLA BOTTLING WORKS (ACTION TO ENJOIN OBSTRUCTION TO NATURAL FLOW OF WATER).

294 S W 2d 522-525 (Ct App Ky 1956).

Descriptors: *Kentucky, Judicial decisions, *Obstruction to flow, *Seepage, Cities, Flood damage, *Sewers, Storm drains, Storm runoff, Legal aspects, Subsurface runoff.

This was an action to enjoin defendant from obstructing the natural flow of water between plain-tiff's building and a lot belonging to the defendant. Defendant had blocked a storm sewer constructed by the city which emptied onto his vacant lot. This prevented the water from flowing over the lot to the river. The court held that to support the injunctive relief sought, proof that the actions of the defendant caused the seepage into plaintiff's building was sufficient. (Childs-Fla)
W69-03291

NIMMONS V CITY OF LA GRANGE (ACTION BY LAND OWNER FOR FLOODING CAUSED BY CITY'S ROAD CONSTRUCTION). 94 Ga App 511, 95 SE 2d 314-318 (1956).

Descriptors: *Georgia, *Flood damage, *Road construction, *Obstruction to flow, Judicial decisions, Cities, Paving, Surface waters, Stagnant pool, Legal aspects, Surface drainage.

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

Plaintiff brought this action for damages against the city of La Grange which paved and curbed the street in front of plaintiff's property. It was alleged that these actions caused an obstruction to the natural drainage from the property resulted in the retention of excessive amount of water on the property. Plaintiff' seeks recovery for the damage caused by the formation of a stagnant pool of water. The Court of Appeals held that a cause of action was stated for damages resulting from the continuous maintenance of a nuisance. The correct measure of damages was held to be an amount such as would reasonably compensate the realty owner for the hurt, inconvenience, and damage to the use and enjoyment of property. (Child-Fla) W69-03293 Plaintiff brought this action for damages against the

MESSINGER V TOWNSHIP OF WASHINGTON (DRAINAGE LICENSE). 185 Pa Super 554, 137 A 2d 890-895 (1958).

Descriptors: Judicial decision, *Pennsylvania, Legal aspects, *Permits, Easements, *Surface drainage, Cities, Drainage effects, Ditches, Drains, Diversion, *Alteration of flow, Pipes.

Plaintiffs sought to enjoin town from diverting water onto their land. Plaintiffs' predecessor in title gave oral permission to defendant to construct drainage facilities on his land which would cause water to flow onto certain portions of the land. When plaintiffs purchased the property they were unaware of the drain pipe until after partial completion of their house. The discharge from the drain interfered with passage to and from the house. The court held that the license granted to defendant need not be in writing and is binding the property of the license became in the court had been as the license became in the court had been as the license became in the court had been as the license became in the court had been as the license became in the court had been as the court had been as the license became in the court had been as the court had cilities on his land which would cause even though gratuitous. The license became irrevocable after the defendants expended money in reliance on it. (Molica-Fla)
W69-03295

EXISTING RIGHTS AND REMEPRESERVED; LIMITATIONS. N Y Conserv Law sec 441 (McKinney 1967). REMEDIES

Descriptors: *New York, *Legislation, *Water resources, Administration, Legal aspects, *Riparian rights, Projects, Project planning, Public rights.

Part V does not change, alter, impair, or enlarge, any riparian or other rights or remedies available to any person, state agency, or public corporation with reference to water resources and use of such waters before passage of the article. It does not alter in any way the jurisdiction of any entity as it existed before passage of the Act. Part V does not require that a regional plan involving water resources be approved before a regional project may be carried out. (Molica-Fla) W69-03297

WATER SUPPLY (STORAGE AND RELEASE

OF WATERS). N Y Conserv Law sec 801 (McKinney 1967) art 4

Descriptors: *Delaware River Basin Commission, Legislation, *Interstate compacts, State guvern-ments, Water policy, *Water supply, Surface water, Ground water, Regulated flow, Public health, Quality control, Diversion, Legal aspects.

The Commission has authority to develop and implement plans and projects for the use of waters of the basin and for that purpose it may provide for and maintain dams and other facilities. For specified purposes, the Commission may operate and control facilities for the storage and regulation of flow of surface and ground waters of the basin. (Molica-Fla) W69-03301

FLOOD PROTECTION.

N Y Conserv Law sec 801 Art 6 sec 6.1, 6.2, 6.3 (McKinney 1967).

Descriptors: *Delaware River Basin Commission, Administrative agencies, *Interstate compacts, State governments, Water policy, *Flood protec-tion, Legal aspects, Public health, *Flood control, Flood plains, Flood plain zoning, Flood routing.

The Commission has authority to construct and maintain facilities for flood damage reduction. The Commission may delineate the areas of the basin subject to flood, and after a public hearing, it may establish standards for flood plain use relative to the risk of flood within the areas. The Commission may acquire land or any interest therein for the purpose of restricting the use of such property to minimize flood hazard. (Molica-Fla) W69-03302

INTERNATIONAL CONFERENCE ON WATER

FOR PEACE 1967.
For primary bibliographic entry see Field 06B. For abstract, see W69-03305

THE CONTINENTAL USE OF ARCTIC-FLOW-

ING RIVERS,
Washington State Univ., Pullman; Washington
Water Research Center, Pullman; and Washington
Univ., Seattle.
E. R. Tinney.

Proc Seminar on Arctic Drainage Basin, Pullman, Washington, Apr 1 to May 20, 1968, 176 p, 1968. 9 chapters, 9 fig, 5 map.

Descriptors: *Planning, *Water resources development, *United States, *Inter-basin transfers, Legislation, Legal aspects, Political aspects, Water allocation (Policy). Identifiers: *North America, *Canada, International water transfers, International water resources development.

The water resources of the arctic drainage basins of North America and the political encouragements and hindrances to their general continental redis-tribution in both the U. S. and Canada are surveyed tribution in both the U.S. and Canada are surveyed in a symposium. Individual papers cover the political and social relationships between the U.S. and Canada, continental water engineering, Alaska's water resources, Canada's water resources, water resources, Canada's water resources, Canadian water resource management, a brief review of the first (U. S.) National Assessment of Water Resources, future U. S. water resource development, economics of massive inter-basin water transfers, and planning for massive water resource development. (Knapp-USGS) W69-03313

HYDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER BASIN, Robert F. Carlson, Donald G. Watts, Gerald J. Stadler, and A. J. MacCormick. Univ of Wisconsin, Madison, Water Resources

Descriptors: *Hydrology, *River basins, *Wisconsin, *Reservoir operation, Simulation analysis, Mathematical models, Data collections, Bibliogra-

phies. Identifiers: *Wisconsin River.

Studies deal with quantities of natural flow, hydrology, and their control by reservoir operation. The main concerns are with water quantity, but, as The main concerns are with water quantity, but, as a sign of the times, not with quantity for its own sake but as a means of achieving a measure of control over water quality. Authors state that studies detailed by them are part of a more comprehensive program being carried on through the Water Resources Center, University of Wisconsin, Madison. The overall program is intended to determine what advantages are to be gained by a regional approach to water quality management and to assess the means by which regional management may be implemented. The report consists of five parts, described as follows: Part I, a selected bibliography on hydrological control by reservoir operation; Part II, an extended analysis, treated by digital simulation, of a water storage reservoir system (Wisconsin River basin); Part III, a brief set of notes, 'On Reservoir Networks,' describing a simple mathematical model; Part IV, 'Linear Random Models of Annual Streamflow Series,' a detailed treatment of non-seasonal time series; and Part V, documenting and describing disposition of data collections used in the studies. Bibliography contains 66 entries. (See also W69-03376--W69-03380). (Eichhorn-Wisc)

SELECTED BIBLIOGRAPHY ON HYDROLOGI-CAL CONTROL BY RESERVOIR OPERATION, Robert F. Carlson, Donald G. Watts, Gerald J. Stadler, and A. J. MacCormick. Hydrology and Reservoir Control on the Wisconsin River Basin, Pt 1, 1968. 6 p.

Descriptors: *Bibliographies, *Hydrology, *Reservoir operation, *River basins, Documentation, Wisconsin, River forecasting, Rivers.

Identifiers: *Wisconsin River.

This bibliography of 66 entries bears on the subject of hydrology and its control by reservoir operation. Included also are references primarily related to the Wisconsin River Basin. Citations are not exhaustive, but the list contains material consulted during preparation of the parent report. (See W69-03375). (Eichhorn-Wisc)

ANALYSIS OF A WATER STORAGE RESER-VOIR SYSTEM, Gerald J. Stadler.

Hydrology and Reservoir Control on the Wisconsin River Basin, Pt II, 1968. 132 p, 25 fig, 7 tab, 25 ref.

Descriptors: *Hydrology, *Mathematical models, *Reservoir operation, *River basins, *Simulation analysis, Computer models, Computer programs, Continuity equations, Hydraulics, Reservoirs, River forecasting, Rivers, Statistical methods, Streamflow, Systems analysis, Water quality, Wisconsin.

Wisconsin.

Identifiers: *Wisconsin River, Linear regressions,
Eau Pleine Reservoir Group (Wis), Rainbow
Reservoir Group (Wis), Rice Reservoir Group
(Wis), Spirit Reservoir Group (Wis).

digital computer model for analysis of the A digital computer model for analysis of the Wisconsin River reservoir system is developed. In the model, a set of continuity equations defines the reservoir system. Solution of the set of equations provides information relative to reservoir content. changes in storage of the reservoirs, and stream-flows at various locations in the basin. Model accounts for flexible reservoir conformations and reservoir operating procedures. A statistical method estimates the flows from ungaged areas. Experimental solutions with historical data verified Experimental solutions with historical data vernicular the model in the sense that actually measured reservoir contents were reproduced with fair accuracy. Author designed his model to simulate Wisconsin River system in studies of water quality Wisconsin River system in studies of water quality control, but, with appropriate adjustments, it applies to other similar reservoir systems. Report includes appendices covering notation, definitions, glossary of symbols used in computer program, and printouts of Wisconsin River basin program and a linear regression program. (See W69-03375). (Eichhorn-Wisc) W69-03377

ON RESERVOIR NETWORKS.

Robert F. Carlson. Hydrology and Reservoir Control on the Wisconsin River Basin, Pt III, 1968. 10 p, 2 fig, 1 ref.

Descriptors: *Mathematical models, *Networks, *Simulation analysis, *Reservoir operation, Continuity equations, Hydrology, River forecasting, Systems analysis. Identifiers: Graph theory, Matrix theory, Topology.

A simple mathematical model is described which may be used as an aid in the solution of problems dealing with reservoir networks. The main feature of the model is that it permits the description of rather complicated arbitrary networks as simple matrices. Author used the numerical solution of the discrete continuity equations for reservoir networks to illustrate application of the model. The report includes three cases as examples: (1) reconstruction of releases - given the amount of water stored in a reservoir (S (t)) and local inflow into the reservoir (i (t)), both as a function of time, the amount of water released from a reservoir (r(t)) as a function of time is found; (2) reconstruction of inflows - given a history of r (t) and S (t), i (t) is found; and (3) computation of storage - given i (t), r (t) and S (t), water storage in the reservoir at next subsequent interval of time is found. (See W69-03375). (Eichhorn-Wisc) W69-03378

LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES, Robert F. Carlson, A. J. MacCormick, and Donald

G. Watts.

Hydrology and Reservoir Control on the Wisconsin River Basin, Pt IV, 1968. 55 p, 12 fig, 2 tab, 16 ref.

Descriptors: *Mathematical models, *Simulation Descriptors: "Mathematical models, "Simulation analysis, *Systems analysis, Hydrology, Parametric hydrology, Rivers, River forecasting, Stochastic processes, Streamflow, Streamflow forecasting, Time series.

Identifiers: *Linear random models, Autocovariance functions, Missouri River, Neva River, Niger

River, Non-stationary processes, St. Lawrence River, Transfer functions.

Linear random models of time series are developed. Parametric models fitted to four annual streamflow series (St. Lawrence, Missouri, Neva and Niger Rivers) illustrate the theory and the method of application of the models. An itetive procedure of identification, estimation, and diagnostic and the series of the seri nostic checking permitted the estimation of model parameters from the data series. The method described leads to models with few parameters and has straightforward applications to forecasting. (See W69-03375). (Eichhorn-Wisc) W69-03379

STREAMFLOW AND PRECIPITATION DATA INDEX, Gerald J. Stadler.

Hydrology and Reservoir Control on the Wisconsin River Basin, Pt V, 1968. 6 p, 1 tab.

Descriptors: *Wisconsin, *Data collections, *Streamflow, *Rainfall, River basins, Data processing, Gaging stations.
Identifiers: *Wisconsin River, US Geological Survey, US Weather Bureau, Univ. of Wisconsin.

Streamflow records through year 1960 for 83 stations located on streams tributary to the Wisconsin River, have been deposited with the Department of Civil Engineering, The University of Wisconsin, in the form of computer cards and magnetic tape.

Tape is in the standard format of the US Geological Survey. Each computer card lists: (1) number of gaging station, (2) year of record, and (3) monthly streamflow record for the year. Gaging station numbers and locations are tabulated in the report. Daily rainfall records (January 1964 - June 1966) were transferred to magnetic tape from surplus data cards furnished by the US Weather Bureau. This tape has also been deposited. A catalog of the data is available. (See W69-03375). (Eichhorn-Wisc) W69-03380

CONVERSION OF GULLIES TO VEGETATION-LINED WATERWAYS ON MOUNTAIN LINED SLOPES.

Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo. Burchard H. Heede.

U S Department of Agriculture, Forest Service, Research Paper RM-40, pp 11, 1968. 11 p, 1 fig, 4 photo, 3 tab, 7 ref.

Descriptors: *Gully's erosion, *Grassed waterways, *Rocky Mountains, Erosion control, Soil conserva-tion, Gullies, Vegetation establishment, Slope stabilization, Colorado, Surface runoff, Water con-

Four gullies were successfully converted to water-ways on slopes of the Rocky Mountains in Colorado. Three years after treatment, they had lost only 9 percent as much soil as comparable un-treated gullies. Careful engineering survey and design, close construction supervision, and good response to revegetation measures were responsible for the success. Since limits of applicability could not be established, the method is proposed for application on sites comparable to those of the sudy area. W69-03406

JERUZAL V HERRICK (STATUTORY AUTHORITY OF DRAIN COMMISSIONER). 350 Mich 527, 87 NW 2d 122-126 (1957).

Descriptors: *Michigan, *Drainage system, *Sewers, *Legislation, Judicial decisions, Storm drains, Surface runoff, Surface waters, Jurisdiction, Administrative agencies, Public health, Remedies, Projects, Legal aspects, State governments, Local governments. Identifiers: Mandamus.

A statute authorized the county drain commissioner to construct drains, and listed in its definition of 'drain' the term, 'any sewer.' The commissioner proceeded with the planning and financing for a sanitary sewer for an area within the county The commissioner stopped the proceedings until the legal question of whether he had authority to construct this sewer could be determined. The problem concerned the definition of 'drain' under the statute, and specifically, whether it included the system designed solely as a sanitary sewer, completely closed to surface or storm water drainage. Interested property owners filed application for a writ of mandamus to direct the commission to install the sewer. The court issued the writ, ruling that there was nothing in the language of the statute to preclude the commissioner from installing this particular sewer system. (Wheeler-Fla) W69-03426

HUDSON V VILLAGE OF HOMER (RIGHT TO REMOVE DAM).

351 Mich 73, 87 N W 2d 72-78 (1957).

Descriptors: *Michigan, *Drainage programs, *Prescriptive rights, *Mill dams, Judicial decisions, Drainage, Backwater, Water law, Riparian land, Riparian rights, Public rights, Drainage districts, Administrative agencies, Recreation, Dams, Ponding, Ponds, Legal aspects, Local governments, Fishing.

Owners of a dam proposed to convey the dam to a county drainage board. The dam, constructed about one hundred years prior to this action, created a pond which extended into a village. The pond followed the natural bed of a stream, and cur-rent through the pond was perceptible. The drainage board wished to remove the dam, and drainage board wished to remove the dam, and with it the pond, in order to improve the drainage of district lands. The village contended that the pond had been generally used for public and riparian boating, bathing, fishing, and hunting, and that such use had continued without interruption for such an extended period of years as to result, by estoppel and prescription, in the acquisition of public and riparian rights against the dam owner. The board filed a bill for declaratory relief to ascertain whether these contentions were sound before tain whether these contentions were sound before proceeding with the project. The lower court ruled that the board had the right to remove the dam. The appellate court affirmed, and pointed out that

those people using a mill pond for recreational and riparian purposes are continuously charged with notice that the pond is artificial and that its level may be lowered or returned to its natural state, by the owners, at any time. (Wheeler-Fla) W69-03427

DEMOSKI V STATE (CLAIMS AGAINST STATE ATTRIBUTED TO FLOOD PROTEC-TION PLAN). 168 NYS 2d 242-250 (Ct Cl 1957).

Descriptors: *New York, *Legislation, *Federal government, *Bank erosion, Judicial decisions, Legal aspects, Channel improvement, Erosion control, Flood protection, River basin development, Appropriation, Easements, State governments, Retaining walls, Banks, Damage.

Identifiers: Negligence, The Flood Control Act of

Plaintiff claims damages against the state due to its negligence in allowing defective flood protection project to damage plaintiff's retaining wall and erode his river bank. Plaintiff had built and maintained a retaining wall which had protected its adjoining land from high water erosion prior to 1956. Pursuant to the Flo Code, tit 33, ch 15) and state legislation (L 1936, ch 862, as amended McK Unconsol - Laws, sec 1301 ct seq) the State gained temporary possesion of claimants' lands in order to remove shrubs and debris from the river shoreline. Contractors of the State removed all shrubs and uprooted trees to complete the flood protection project. Sub-sequently in 1956 highwaters eroded claimants' bank, destroyed his retaining wall and damaged his property improvements. The court held that the State had a non-delegable duty to see that any work done on claimants' land pursuant to flood protection plan would not in the natural course of events cause injury to such land. Since provisions against erosion were not taken, claimant was awarded damages based upon the lesser of restoration costs or dimunution of property. W69-03430

CONSTRUCTION AND DEVELOPMENT OF EXCESS DRAINAGE FACILITIES - CONTRACTS,

N Y Gen Mun sec 119c-d (McKinney 1965).

Descriptors: *New York, Legislation, *Cities, Drainage, *Drainage districts, Disposal, Construction, *Excess water, Sub-surface waters, Surface waters, Storm runoff, Contract, Legal aspects, Conveyance structures, Rates, Local governments. Identifiers: Counties.

A municipality or county, on behalf of its drainage district, may, in addition to its other powers with respect to construction and development of drainage facilities, provide for the construction and development of capacity in excess of its own needs in order to convey and dispose of storm waters and other surface and sub-surface water collected by another public corporation and may contract in-debtedness for such purpose. Section 119-d allows a municipality authorized to construct drainage a municipality authorized to construct drainage facilities in excess of its own needs to enter into contracts for such purpose as long as they do not exceed 40 years. The contracts can contain provisions for the establishment and revision of charges for conveyance of disposal of the water collected and for adjudication of disputes. (Shevin-Fla) W69-03431

REGULATION OF OPEN WELLS, CESSPOOLS, BASINS OR SUMPS.

N Y Gen Mun sec 99 328-329 (McKinney 1965).

Descriptors: *New York, Legislation, *Cities, Wells, Well screening, *Well regulation, Cesspools, Sumps, Basins, *Construction, Regulation, Legal

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control of Water on the Surface

aspects, Cities, Local government, Administrative agencies. Identifiers: Open wells, Fencing.

Section 99, regulation of open wells, cesspools, basins, or sumps, provides that the governing board of a municipality may regulate, by local law, ordinance or resolution, the construction and maintenance of open wells, cesspools, basins, or sumps. They may require that the installations be adequately covered or surrounded by protective fencing. The local authorities shall establish the penalties for violation of the ordinances. However, this statute does not deprive the state water power and control commission of any jurisdiction they now or hereafter have pursuant to the conservation law. (Shevin-Fla)

GRIFFITH V HURT (JOINDER OF PARTIES IN SUIT FOR DAMAGES CAUSED BY OBSTRUCTION TO FLOW).

291 S W 2d 271-273 (Tenn 1956).

Descriptors: *Tennessee, Judicial decisions, Damages, *Flooding, *Obstruction to flow, Natural flow, Streams, Diversion, Legal aspects. Identifiers: Nuisance.

This was a suit by the owners of separate farms for an injunction against maintenance of a nuisance in interfering with the flow of waters and for resulting damages. The court held that two or more persons may unite in a bill to enjoin a nuisance, although their lands are separate and distinct, where the lands are affected in substantially the same way, but there may not be such joinder for separate and individual resulting damages. (Childs-Fla) W69-03434

LEEK V BRASFIELD (WRONGFUL FAILURE TO PERMIT DAM REPAIRS).

290 S W 2d 632-636 (Ark 1956).

Descriptors: *Arkansas, Judicial decisions, Dams, Legal aspects, Canals, Drainage systems, Drainage water, Drainage programs, *Rain water, *Dam failure, Dams, Administrative agencies, *Flood damage, Rain, Floods. Identifiers: Wrongful conduct, Upper landowner,

Identifiers: Wrongful conduct, Upper landowner Lower landowner.

Plaintiff's land was situated below defendant's farm on a drainage canal constructed by the drainage district. The district, many years before this action, had constructed a dam which diverted creek water into the canal. In 1953, some unknown person cut the dam, thus exposing the plaintiff's land to flood danger. Plaintiff asked the drain commissioners to repair the dam, who then authorized employment of a contractor to make the repairs. Defendant prevented the contractor from beginning the work by threatening to tie up his equipment in court. A month later, heavy rains caused flooding to plaintiff's land. Plaintiff sued the upper landowner for damages, and the trial court allowed recovery. The appellate court affirmed, ruling that the issue of the upper landowner's liability was a question for the jury. Defendant argued that the contractor's attempt to repair was illegal, but the court ruled that the district was authorized by law to repair its drainage system. The court held that the wrongful act of cutting. A dissenting opinion was based upon the feeling that the verbal threat of filing a lawsuit against the contractor was insufficient action by which to be held liable for the resulting damage. (Wheeler-Fla)

DRAINAGE DISTRICT NO 48 OF DUNLIN COUNTY V SMALL (NUISANCE ACTION BY DRAINAGE DISTRICT TO ABATE PRIVATE

LEVEE

311 S W 2d 29-41 (Ct App Mo 1958).

Descriptors: *Missouri, *Levees, *Abatement, Judicial decisions, Flood control, River regulation, Competing uses, Relative rights, River basins, Flood plains, Navigable rivers, Drainage districts, Easement, Swamp.

In a suit by the plaintiff drainage districts against the defendant landowners, the districts sought to have a private levee declared a nuisance and asked for its abatement. The district claimed that it possessed an easement for flowage purposes over all sessed an easement for flowage purposes over all the lands in the area including the lands owned and impounded by the defendants. All the lands in question are swamp and overflow lands in the St. Francis River basin. The trial court found for the defendants, and the question on appeal was whether the plaintiff acquired flowage rights or easements over the defendants' lands when the member flood control districts were enlarged via successive consolidations. The court refused to find that the defendants' lands were contained within the channel of the river which would make them subject to the exclusive control of the plaintiff districts. The defendants' lands had devalued in ownership from the United States to the county and by private sale to the defendants. The court found that, when the districts were first formed, the lands now owned by the defendants were owned by the county, and that the condemnation notice published by the district was insufficient to alert the published by the district was insufficient to alert the county. As notice had not been given the county, such notice could not be held against the defendants who were the grantees of the county. The recital 'to all other persons interested' contained in the notice issued by the plaintiffs was not sufficient to include owners of land not located within the strip of land actually condemned for the purpose of erecting a levee and drainage ditch. The judgment for the defendants was affirmed. (Blunt-Fla) W69-03437

SHOWS V CITY OF HATTIESBURG (NEGLIGENT MAINTENANCE OF DRAINAGE DITCH).

97 So 2d 366-368 (Miss 1957).

Descriptors: *Mississippi, Judicial decisions, *Ditches, *Cities, Legal aspects, Maintenance, Operation and maintenance. Identifiers: *Sidewalks, Personal injuries.

This is an action brought by a parent for personal injuries to his minor son. The child became tangled in grass growing between a walkway and a drainage ditch and fell into the ditch. The ditch had been constructed and maintained by the city. Plaintiff alleged negligence on the part of the city. The ditch was an open one, filled with debris, which ran parallel to a street and dirt walkway across the street from a public school. The court held that the city was liable for injuries which resulted from negligent maintenance of its streets and sidewalks. (Sisserson-Fla) W69-03438

DISPOSITIONS OF STATE LAND.

N C Gen Stat secs 146-5, 146-6, 146-8, 146-12, 146-13 (1964).

Descriptors: *North Carolina, *Swamps, *Canals, Legislation, Beds, Regulations, Taxes, Navigation, Drainage, Navigable waters, *Fill, Administrative agencies, Islands, Minerals, Permits. Identifiers: *Title to raised lands, State lakes.

The state may reserve the following powers when it sells swamp lands: (1) to make reasonable regulations respecting the repair or enlargement of canals cut by the state; (2) to impose taxes on lands benefited by the canals; (3) to maintain the free navigation of the canals; (4) to regulate the drainage into the canals; (5) to insure that the

roads along the canal banks are public. This article establishes rules for determining the ownership of land raised from navigable water. The state is authorized to dispose mineral deposits in state lands under water, but this shall be subject to all rights of navigation and other conditions imposed by the state. The Department of Administration may grant easements in lands covered by navigable waters or state lakes to adjoining riparian owners, but they shall not impair navigation. A permit is required in order to erect any structure in or upon the waters of any state lake. (Childs-Fla) W69-03440

WOLFSEN V UNITED STATES (RIVER DIVERSION).

162 F Supp 403-440 (Ct Cl 1958).

Descriptors: Judicial decisions, Legal aspects, *California, *Central Valley Project, Riparian rights, Foreign waters, Federal government, Water rights, Projects, *Diversion loss return, *Irrigation water, Rivers, Federal Reclamation Law, Diversion

Identifiers: Foreign waters doctrine.

Plaintiffs, riparian land owners, brought an action for damages against the United States for impairment of water rights which resulted from a diversion of the San Joaquin River for governmental purposes and the substitution of water from the Sacramento River. Plaintiffs' deed contained riparian water rights to the San Joaquin River subordinated to the water rights of the grantor. They obtained irrigation water from Salt Slough, a branch channel of the San Joaquin. Plaintiffs' assertion of damages rested on the ground that their riparian rights were in the San Joaquin and the substitution of the water from the Sacramento operated to divest them of their rights based on the foreign waters doctrine which allows one who discharges foreign waters into a stream to take them away with impunity. The court found that the United States faithfully fulfilled its guarantee to provide substitute waters, and that any impairment of the landowner's rights was at most a technicality. The court held that the foreign waters doctrine did not apply, and the United States could not with impunity take away substitute waters. Detailed findings of fact are included in the opinion. (Molica-Fla)

MOULTON V BUNTING MCWILLIAMS POST NO 658 (DIVERSION OF NON-NAVIGABLE STREAM).

213 Ga 859, 102 SE 2d 593-595 (1958).

Pescriptors: *Georgia, *Natural flow doctrine, *Riparian rights, *Diversion, Judicial decisions, Riparian waters, Dams, Non-navigable waters, Alteration of flow, Obstruction to flow, Reasonable use, Relative rights.

Plaintiff sought to recover damages against defendants by reason of their maintaining a dam across an unnamed, non-navigable stream. Plaintiff alleged this diverted the natural flow of the water, thus depriving him of his right to the normal and natural flow of water through his premises. He also sought an injunction to enjoin defendants from maintaining the dam. The defendants answered that at the time the dam was constructed, the plaintiff had no riparian rights in the stream, because at that time he did not own, but merely leased, the land. The court held that running water on land belongs to the owner of the land, and the diversion or obstruction of a stream so as to impede its course is a trespass upon the lower riparian owner's property. The legal and equitable relief sought by the plaintiff was based upon his rights as a riparian owner. However, at the time the suit was instituted, the plaintiff did not own the property. Therefore, the court held that he was not entitled to the relief sought. Subsequent acquisition of title pending the suit did not cure this deficiency. (Scott-Fla)

W69-03443

MUNICIPAL AND PARISH BRIDGES. LSA-RS 48:831, 48:859 (1965).

Descriptors: *Louisiana, *Legislation, Water law, Highways, *Bridges, *Bridge construction, Cities, Canals, Channels, Lakes, Administrative agencies, Gulf of Mexico, Bays, Bayous, Riparian rights, Beds, Local governments, Tunnels, Legal aspects, Riparian lands, Eminent domain.

Any parish or municipality of the State of Louisiana is authorized to construct, acquire, improve, operate, and maintain tunnels, causeways, bridges, or any combination of such facilities, including all necessary approaches, fixtures, accessories, and equipment, in, over, through, or under the waterways of the state. A parish may purchase any lands, structures, rights of way, franchises, servitudes, and other interests in lands, including lands under water and riparian rights, deemed necessary for the construction of the bridge. The State of Louisiana consents to the use of all lands lying under water which are within the state and are necessary to the construction of any such bridge. All bridges constructed by a parish must first receive the approval of the department of highways. (Watson-Fla)

SERVITUDES WHICH ORIGINATE FROM THE NATURAL SITUATION OF THE PLACES. L A S - C C Art 660-661 (1967).

Descriptors: *Louisiana, *Natural flow doctrine, State governments, Riparian land, Riparian waters, Riparian rights, Dams, Relocation, Flow, Flow rates, Relative rights, *Alteration of flow, *Obstruction to flow, Reasonable use, Legislation, Legal aspects, Diversion.

A lower riparian owner is required to receive waters that flow naturally from upper riparian lands. The lower riparian owner is prohibited from erecting any structure to prevent the natural flow of the water. The upper riparian owner may not do anything to make the flow more burdensome Riparian owners may use the running water for irrigation and other purposes. Riparian owners may use the water that runs over their lands, but cannot stop it or change its direction: Such water must be returned to its ordinary channel where it leaves the owner's land. (Scott-Fla)

RIGHTS OF USUFRUCTUARY. LSA-CCArt 553 (1967).

Descriptors: *Louisiana, Boundaries (Property), Leases, Islands, *Relative rights, State governments, *Accretion (Legal aspects), *Usufructuary right, Alluvion channels, Legislation, Legal aspects, Riparian rights, Riparian land. Identifiers: Treasures.

The user of land also gets the use of accreted land, but has no right to islands formed in a stream opposite the land. Such islands belong to the riparian owners. Furthermore, the user has no right, not even the right of enjoyment, to treasures which may be discovered on land which he is using, unless he has discovered the treasures himself. In the latter case, he shall have the rights of one who has found treasure lost by another. (Scott-Fla) W69-03447

RIGHT OF ACCESSION - IMMOVABLES.

LSA-CC Arts 509-518 (1967).

Descriptors: *Louisiana, *Boundaries (Property), Ownership of beds, Relative rights, Riparian land, State governments, *Accretion (Legal aspects), Bank erosion, Banks, Navigable waters, Navigable rivers, Streambeds, Islands, Sand bars, Rivers, Legislation, Legal aspects, Non-navigable waters, *Alluvion, Deltas, Alluvial channels.

Accretions formed successively and imperceptively to any soil situated on the shore of any body of water are called alluvion. Alluvion belongs to the owner of the soil situated on the edge of the water. The same rule applies to derilictions formed by running water retiring slightly from one of its shores and encroaching on the other. If the water suddenly carries away an identifiable tract of land, the owner may claim his property within one year, or any time before the person to whose land the removed soil unites takes possession of the same. Islands and sand bars, not attached to the bank, formed in the beds of navigable waterways, belong to the state. Islands and sand bars formed in nonnavigable streams are the property of the riparian landowners, and are apportioned according to specified rules. If a river or stream changes its course and surrounds the property of an owner of the shore, making it an island, the owner shall keep his property. If a river or stream changes course, the owners of the land newly occupied by the stream shall take the former bed of the stream as indemnifiation. If the stream returns, they shall retake their former property. (Scott-Fla) W69-03448

THINGS - DIVISION OF THINGS. LSA - CC Arts 450-453, 455, 457 (1967).

Descriptors: *Louisiana, Admiralty, Local governments, *Ownership of beds, *Public rights, *Public benefits, Recreation, Riparian waters, Riparian land, State governments, Oceans, Seashores, Highwater mark, Navigable rivers, Navigable waters, Harbors, River beds, Public lands, Banks, Levees, Legislation, Legal aspects, Usufructuary right.

Running water and the sea and its shores belong to and may be used by everyone. The sea shore extends from the water to the high water mark during the winter. Use of the sea shore is subject to the police power of the municipality within which it is located. Navigable rivers, seaports, roadsteads and harbors, and riverbeds, so long as they are covered with water, are public property; everyone has a right to fish in same. The use of the banks of navigable rivers or streams is also public; everyone has a right to land his vessels, load and unload his vessels, and to dry his fishing nets thereon. The ownership of the banks nevertheless belongs to those who own the adjacent land. The banks of a river or stream are construed as that which usually contains it, except, where there are levees established by law, the levees shall form the banks. (Scott-Fla)

FERRIES, CANALS AND PUBLIC LANDINGS. Mass Ann Laws Ch 88, secs 12-19 (1967).

Descriptors: Canals, Cities, Waterway, *Local governments, Regulation, *Tidal waters, Low water mark, Boundaries, Legislation, Legal aspects, *Sites, *Locating. Identifiers: Landing places.

Section 12 establishes the procedure to be followed by a city council or the selectmen of a town in order to erect a fence along a waterway deemed dangerous. Section 13 deals with the procedure for erecting a fence if an order to so do by the city council or the selectmen is not complied with. Section 14 sets out the task of every city or town where the tide ebbs and flows to provide at least one common landing place. Section 15 concerns the potential role of the county commissioners in selecting or approving a common landing place. Section 16 provides that when ten or more inhabitants of a county represent that the exact location of a common landing area cannot be readily ascertained, the county commissioners shall ascertain the correct location. Section 17 deals with the procedure for discontinuance of a common landing place. Section 18 requires, regarding appeals from these sections, that a sufficient recognizance be given to the county to cover the appeal costs. Section 19 concerns the making of rules and regulations

governing the use of a common landing place. (Carruthers-Fla) W69-03451

GENERAL DRAINAGE.

Fla Stat secs 298.40-298.81 (1967).

Descriptors: *Taxes, Ditches, *Drainage district, Lakes, *Legislation, Drainage, *Florida, Canals, Land tenure, Dredging. Identifiers: Bonds, Everglades Drainage District, Florida drainage association.

Landowners in the drainage district may construct ditches through the property of intervening landowners to reach the public ditches. Various procedures are provided for obtaining land for the drainage district. Civil and criminal liability is established for willfully damaging or obstructing drainage canals, works, etc. The owner is defined as the owner of the freehold estate. The composition and powers of the State Board of Drainage Commissioners are described. The drainage of any lake greater in area than two square miles is prohibited without the consent of all the owners of the abutting property. This section is not applicable to the Everglades Drainage District. Foreclosure proceedings by the district are described. It is expressly provided that special legislation may increase or decrease the powers of a drainage district. (Childs-Fla) W69-03453

GENERAL DRAINAGE.

Fla Stat secs 298.01-298.25 (1967).

Descriptors: *Florida, *Drainage district, *Land reclamation, Wetlands, Condemnation, Land surveys, Bridges, Legislation, Taxes. Identifiers: *Overflowed lands, Drainage plan.

The methods and requirements for the formation of a drainage district are provided. The general purposes are to protect and reclaim overflowed lands. If the costs of a district exceed the benefits it will give, then the circuit courts will order it to dissolve. Adjacent districts may consolidate if the owners of a majority of the acreage vote to do so. The life of a district may be extended. No appeal from any action under this chapter will act as supersedeas. The procedure for electing the board of supervisors is explained and their powers are enumerated. The board appoints a chief engineer, who submits reports on his land surveys, drainage plan and controls all engineering work. All other employees are selected by the board. The board possesses broad reclamation powers, which extend to land outside the district. The requirements for bridge construction are described. They must conform to the engineer's specifications. Their cost is to be borne by the landowner. If they are constructed in counties having at least 130,000 residents, then the county engineer and county commissioners must approve the specifications. (Childs-Fla) W69-03454

GENERAL DRAINAGE.

Fla Stat secs 298.26-298.39 (1967).

Descriptors: *Land appraisal, Watercourses, Damages, Benefits, Condemnation, *Land reclamation, Drainage systems, Canals, Ditches, Costs, Land, *Taxes, Land tenure, Financing, *Florida.

All taxes are uniform and are not to exceed fifty cents per acre. Existing canals, ditches, drainage systems or watercourses may be incorporated into the drainage plan. Commissioners appointed by the Circuit court appraise condemned lands, assess benefits and damages and estimate the cost of works. Lands outside the district that are benefited may be incorporated within the district. The court will make this decision. Property which is needed

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control of Water on the Surface

will be condemned whether inside or outside the district. Interested parties may appeal any decision to the district court. When property is not benefited, the taxes assessed will be returned. Taxation of all land, including state property, is taxed in proportion to the benefits received. The methods for payment and collection of these taxes are provided for. The rights accruing to the district when taxes are not paid are defined. (Childs-Fla) W69-03455

DECLARATION OF POLICY.

N Y Soil Conserv Dist Law sec 2 (McKinney 1949).

Descriptors: *New York, *Conservation, *Public health, *Water policy, Soil conservation, Water conservation, Wildlife conservation, Flood control, Legislation, Erosion control, Water control, Maintenance, Dams, Reservoirs, Natural resources, Navigability, Water resources development, Drainage, Land management.

The policy of the Legislature of New York is to provide for soil conservation control and prevent soil erosion, preserve natural resources, assist in the control of floods, assist in the drainage of agricultural lands, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, preserve wildlife, and to promote and protect the health, safety, and general welfare of the people of New York. (Sisserson-Fla) W69-03456

USE AND PROTECTION OF WATERS. NY Conserv Law sec 429a (McKinney 1967).

Descriptors: *New York, *Legislation, Permits, *River flow, *Riverbeds, Water resources, Water management (Applied), Legal aspects, Streambeds, Streams, Administrative agencies.

New York prohibits the changing or disturbance of the course of any stream or the removal from its bed of any material without a permit from the Water Resources Commission. The Commission will consider the probable effect of an alteration on the public and natural resources before issuance of the permit. The Commission may hold a public hearing if it feels that damage may result from the proposed alteration. No permit is required of any state department, state public corporation or any public corporation which has entered into a written memorandum of understanding with the Commission. Emergency work may be undertaken not-withstanding the above, provided the Commission is informed of such action within 48 hours after commencement and 48 hours after completion of such work by registered mail or telegraph. (Molica-Fla) W69-03457

PUNISHMENT FOR VIOLATIONS. N Y Conserv Law sec 429-f (McKinney 1967).

Descriptors: *New York, *Legislation, Permits, *River flow, *River beds, Water resources, Water management (Applied), Legal aspects.

Anyone changing or altering the course of any stream or removing material from its bed without stream or removing material from the Water first obtaining a permit to do so from the Water Resources Commission is guilty of a misdemeanor, and subject to a fine of \$500 and/or imprisonment and subject to a line of \$500 and/or imprisonment not to exceed one year. An agent or employee of such person who knowingly violates the act and a prime contractor of such person who knowingly or unknowingly violates the act, is also guilty of a misdemeanor. (Molica-Fla)
W69-03458

UNLAWFUL INTERFERENCE WITH PROVEMENT WORKS. N Y Conserv Law sec 617 (McKinney 1967).

Descriptors: *New York, Legislation, State governments, *Conservation, Administrative agencies, Water resources, *Utilities, Dams, Dikes, Gates, Channels, Obstruction to flow, Streams, *Construction, Rivers, Legal aspects, Beds.

Anyone who, without the consent of the commission, damages, alters, changes, or interferes with any works constructed under this article; or who opens or closes a gate or gates in any dam, dike or headrace constructed under this article; or who obstructs any channel constructed under this article. shall be guilty of a misdemeanor. After an improve-ment of a channel or watercourse has been authorized, it shall be unlawful for anyone to construct any dam or other structure on the bed of or across such stream until the commission has found that such construction will not unduly affect the proposed or completed project. (Scott-Fla) W69-03459

WATER SUPPLY. N Y Conserv Law sec 835 Art 4 secs 4.1, 4.2 (McKinney Supp 1968).

Descriptors: *New York, Civil law, Legislation, Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, Conservation, Planning, Water resources, Water conservation, *Water supply, Water utilization, *Water storage, *Discharge (Water), Dams, Reservoirs, Public health, Recreation, Regulated flow, Legal aspects, Management, Water pollution control, Economics.

The conservation commission shall have the power to develop and implement projects and plans for using water of the basin for domestic, municipal, using water of the basin for domestic, municipal, agricultural and industrial water supply. In so doing, the commission may obtain and maintain dams, reservoirs, and other facilities and related structures both on the river and off. The commission may also control such structures for the storage and release of waters, for regulation of storage and release of waters, for regulation of flows and supplies of surface and ground waters of the basin, for the protection of public health, welfare, economic development, recreation, and for the abatement of pollution. (Scott-Fla) W69-03461

WITHDRAWAL AND DIVERSION FROM PRO-

TECTED AREAS.

N Y Conserv Law sec 835 Art 11 secs 11.1, 11.2, 11.3, 11.4, 11.5 (McKinney Supp 1968).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, *Conservation, Planning, Natural resources, Water resources, Water conservation, *Withdrawal, *Diversion, Reasonable use, Droughts, Permits, Regulation, Flow augmentation, Legal aspects, Watershorters

The conservation commission has the power to regulate and control withdrawals and diversions from surface and ground waters of the basin. This power is delegable. If the commission determines that a water shortage is threatened or developing, any such affected area may be designated as a protected area. The protected status of the area contents of the commission let these threateneds. tinues until terminated by the commission. In these tinues until terminated by the commission. In these protected areas, no person may divert or withdraw water for any purpose in excess of the quantities prescribed in the commission's general regulations, except pursuant to a properly-issued permit. Should a drought or other emergency cause an actual and immediate shortage of water, the commission may, upon declaration of an emergency, for the limited period of the emergency, further modify any allocations, diversions, and releases previously granted. (Scott-Fla) W69-03462

OPERATION OF HYDRO-ELECTRIC PLANTS AT CRESCENT AND VISHER FERRY CON-TROL OF SARANAC LAKE LOCKS. N Y Canal Law secs 130, 132 (McKinney Supp 1968), 1 p.

Descriptors: *New York, Legislation, Canals, Dams, *Hydroelectric power, *Hydroelectric plants, Lakes, *Locks, Maintenance, Administra-tive agencies, Management, Legal aspects, Repair-

Section 130 gives the commissioner of transporta-tion charge of the hydroelectric plant constructed for the development of electric energy from water power at the Crescent and Vischer Ferry dams. He shall exercise the same powers over them that he has over other structures on the canal and they shall be maintained and operated as part of the canal system. Section 132 gives the commissioner of transportation the same control over the lock system of the Saranak Lake as he has over the canal system. He is authorized to make any improvements and repairs as may be necessary, and all ex-penses incurred will be defrayed from money available for maintenance of the canal system. (Shevin-Fla) W69-03467

ACCELERATING OR IMPEDING FLOW OF MINERAL WATERS.

N Y Pub Lands Law sec 90 (McKinney 1951).

Descriptors: *New York, *Mineral waters, *Pumping, Salts, Wells, Water types, Well regulation, Flow augmentation, Natural flow, Gases, Legal aspects, *Legislation.
Identifiers: Carbonic acid.

Accelerating or impeding the natural flow of mineral waters holding in solution natural mineral salts and an excess of carbonic acid gas is declared unlawful. (Childs-Fla) W69-03471

WASTE OF MINERAL WATERS HOLDING SALTS AND EXCESS CARBONIC ACID GAS.

N Y Pub Land Law sec 92-a (McKinney 1951).

Descriptors: *New York, *Pollution, *Mineral water, Salts, Gases, Administrative agencies, Administrative regulation, Springs, Water types, *Legislation, Legal aspects.
Identifiers: Carbonic acid.

The waste of mineral waters holding in solution ne waste of mineral waters holding in solution natural mineral salts and an excess of carbonic acid gas is unlawful. The permitting of the flow of such mineral waters, except for immediate sale, for longer than twenty-four hours in any one month, is presumptive evidence of the waste thereof. (Childs-Fla) W69-03472

CENTRAL NEW YORK BROADCASTING CORP V STATE (STATE NOT LIABLE FOR DAMAGES FLOWING FROM FEDERALLY-CONTROLLED FLOOD CONTROL PROJECT).

158 N Y S 2d 650-654 (App Div 1957).

Descriptors: Federal government, State government, *New York, Water resources development, Flood prevention act, Flood control, Flood, *Spring flood, *Erosion, Damages, Legal aspects, Judicial decisions, Water law, Third party effects, Flood damage, *Construction. Identifiers: Army engineers, Negligence.

Plaintiff sued State of New York for damages caused by erosion on plaintiffs' property caused by negligent construction of a flood control project. negligent construction of a flood control project. The court found that the work was done in connection with federal-state program of flood control under the general jurisdiction of the U S Army and immediate supervision of the Chief of Engineers. The court held that as the state merely supplied the land but was not in control of the land or the project, it incurred no liability for injuries 'flowing' from the project. Damage occurred during a spring flood when the project was unfinished. The court found no defect in the project plans or construction and that the damage was not reasonably foreseeable, thus no negligence was established. (Graham-W69-03473

KENNEDY-CHAMBERLIN DEVELOPMENT CO V SNURE (MUNICIPAL DRAINAGE SYSTEMS).

212 Md 369, 129 A 2d 142-148 (Ct App 1957).

Descriptors: Judicial decisions, Legal aspects, *Maryland, *Cities, Erosion, Damages, *Drainage systems, Surface drainage, Drainage practices, *Riddance (Legal aspects), Surface waters, Highways, Discharge (Water).

Plaintiffs, lower land owners, sought to enjoin defendent city from constructing new roads on adjacent upper land, which would increase the flow of drainage water over their land, until such time as defendents agreed to revise a proposed drainage system so that their property would not be damaged. There was no present invasion of the property rights of plaintiffs and therefore the situation did not merit judicial interference with the completion of the proposed public improvements. The court said the plaintiffs could seek redress in the future for any damages they might suffer because of the completed improvements. However, generally, a municipality is not liable for damages from increased flow arising from the regular course of municipal expansion, unless it collects and casts a substantially increased volume of water onto adjacent land. (Molica-Fla)
W69-03479

A STUDY OF THE DRAINAGE OF IRRIGATED

A STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN ELECTRICAL RESISTANCE ANALOGUE, Water Conservation and Irrigation Commission, (Australia); and Melbourne Univ., Parkville (Australia). Dept of Agricultural Engineering. R. G. Mein, and A. K. Turner.

J Hydrol, Vol 6, No 1, pp 1-14, Jan 1968. 14 p, 9 fig, 13 ref.

*Resistance, *Analog models, *Dunes, *Electrical resistance, Irrigation effects, Drainage, Model studies.

Identifiers: *Artificial drainage, New South Wales, Impermeable laver.

The drainage of irrigated sand dunes by means of an electrical resistance analog is described. Sand dunes to be irrigated in New South Wales can be dunes to be irrigated in New South wates can be described as having an impermeable layer represented by either a horizontal plane at the base, or a plane parallel to a sloping face. The artificial drainage of these dunes differs from situations covered by formulae commonly used for flat land. The electrical resistance analog is shown to land. The electrical resistance analog is shown to be suitable for studying sand dune problems. The analog solutions are compared with the theoretical predictions of the appropriate formulae. Based on results obtained, recommendations are made on the best means of draining these sand dunes. (L-lavarias-USGS) W69-03526

OPTIMAL CONTROL OF LINKED RESER-

Water Planning for Israel Ltd. Tel Aviv; and Water Research Association, Medmenham (England). For primary bibliographic entry see Field 06A. For abstract, see. W69-03571

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN IL-

Corps of Engineers, Chicago, Ill. For primary bibliographic entry see Field 06B. For abstract, see . W69-03591

PROBLEMS OF MAINTAINING BAYS AND ESTUARIES--A PANEL, SAN FRANCISCO BAY, Joseph E. Bodovitz.

32nd North American Wildlife and Natural Resources Conference, San Francisco, California, Transactions, March 13-15, 1967, pp 120-126.

Descriptors: *California, *Coastal engineering, *Land reclamation, Land management, Recreation, Regions, Southwest U. S., Pacific coast region, Geographical regions, Bays, Bodies of water, Management, Engineering, Property values, Wildlife, Animals, Fish, Aquatic animals, Aquatic life.

As a result of extensive diking and filling, San Francisco Bay has been reduced to 1/3 the size it was at the time of the Gold Rush. This steady filling of the Bay has prompted a detailed study and plan for the Bay waters and shoreline, scheduled for completion in January, 1969. At present the five harmful effects of land reclamation as it exists in the San Francisco Bay are: (1) esthetics and real estate values go down, (2) recreation uses are cut by the present inaccessibility of the Bay, (3) only 75 square miles of marsh and tidelands remain to support fish and wildlife, and (4) the population will be acceptable and the waters. double by mid-twenty-first century, and the waters of the Bay are steadily decreasing. W69-03616

FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,

For primary bibliographic entry see Field 05G. For abstract, see . W69-03627

CLOSING OF THE SEA ARMS.

Dienst der Zuiderzeewerken, The Hague, Netherlands, July, 1967.

Descriptors: *Coastal engineering, *Benefits, *Costs, *Commercial fishing, *Foreign countries, Standing waters, Shore protection, Dam construction, Land reclamation, Drainage, Reservoirs, Engineering, Lakes, Construction, Recreation, Transportation, Geographical regions, Regions, Bodies of water, Impoundments, Surface waters.

There are many tangible advantages to the construction of new sea walls to close the sea arms in the Netherlands Delta area: (1) The existing coastline will be shortened, thus decreasing the force of the ocean on the land; (2) Security against floods will be increased; (3) A fresh water supply can gradually be built up in reservoirs created by the enclosures; (4) Land reclamation from presently unindated areas provides more living space for overcrowded areas; (5) Creation of new recreational areas will result; (6) Increased efficiency of transportation in the Delta area. These advantages are offset by losses which will be suffered by the commercial fisheries in the Delta; however, it is felt that the advantages gained justify this liability. W69-03630

THE DUTCH TURN THE TIDE.

Fortune, Vol 77, No 3, March 1968, pp 132-137.

Descriptors: *Dams, *Dikes, *Coastal structures, *Flow control, Land reclamation, Structures, Foreign projects, Engineering structures, Hydraulic structures, Earthworks, Embankments, Retaining walls, Walls, Control, Water control, Commercial shellfish, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish, Costs.

This is a short discussion, with photographs, of the Dutch overhauling their system of dams and dikes to control the movement of fresh and salt water through the delta (area 1,900 squere miles). Eighteen miles of dams will cost \$800 million dollars. The damming will necessitate the relocation of a multimillion-dollar shellfish culture. W69-03652

ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF HEMPSTEAD, N.Y.

Estuarine Hearings, Subcommittee on Fisheries and Wildlife Conservation of the Committee on Merchant Marine and Fisheries, House of Representatives, 90th Congress, Serial No. 90-3, March, 1967.

Descriptors: *Dredging, *Landfills, *Local governments, *Legal aspects, *New York, Federal government, Navigable waters, Bodies of water, Governments, Appalachian Mountain region, Geographics: graphical regions, Great Lakes region, Northeast U. S., Regions.

The town of Hempstead, New York, issued permits to dredge navigable waters within the town limits. In the first case, a permit was issued after work had begun; in the second case, the work was completed, after which a letter was sent to the Corps of Engineers showing extent of the dredged area. In general, punitive action is not taken for an infraction of this nature unless the work is found to be detrimental. If corrective measures are called for, the Corps tries to have it done voluntarily. If this fails, the Department of Justice must take action. W69-03665

POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA,

Robert D. Gerard.

Science, Vol 153, No 3138, August 19, 1966, pp 870-871.

Descriptors: *New York, *Reservoir construction, Descriptors: "New York, "Reservoir construction, *Fresh water, *Dams, Appalachian Mountain re-gion, Geographical regions, Great Lakes region, Northeast U. S., Water management, Water types, Construction, Management, Engineering struc-tures, Hydraulic structures, Structures, Hydrologic budget, Regions.

Estimates of the water budget of Long Island Sound suggest that it could become the largest reservoir in the United States, with freshwater surplus equal to 12 times the present needs of New York City. The engineering aspects of this undertaking are within the scope of present technology. The dam struc-tures required to isolate this area from the sea could serve as important highway links in place of highway-bridge projects presently under study. W69-03700

4B. Groundwater Management

WATER SUPPLY (STORAGE AND RELEASE OF WATERS).

For primary bibliographic entry see Field 04A. For abstract, see. W69-03301

INTERNATIONAL CONFERENCE ON WATER

FOR PEACE 1967.
For primary bibliographic entry see Field 06B. For abstract, see. W69-03305

INVESTIGATION OF THE TECHNICAL FEASI-BILITY OF STORING FRESH WATER IN SALINE AQUIFERS, Louisiana State Univ., Baton Rouge. Water

Resources Research Inst.

For primary bibliographic entry see Field 02F. For abstract, see.

WITHDRAWAL AND DIVERSION FROM PROTECTED AREAS. For primary bibliographic entry see Field 04A.

For abstract, see. W69-03462

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

GROUND WATER RECHARGE, DEVELOP-

MENT AND MANAGEMENT, California Univ., Berkeley; and California State Dept. of Water Resources, Sacramento.

Proc 6th Bien Groundwater Recharge Conf, California Univ., Berkeley, Sept 13-14, 1967, 180 p, 1968. Total 4 fig, 28 ref, 1 append.

Descriptors: *Planning, *Water resources development, Administration, Forecasting, Governments, Legislation, Management, Programs.

Identifiers: Symposia, Groundwater resource development.

A conference was held at the University of California, Berkeley, to discuss planning in groundwater resource development. Specific topics were establishment of objectives at the national, state and local level; policies; implementation of policy by legislation and engineering works; and practical constraints such as laws, economic feasibility, social goals, role of the user, technical feasibility, and institutional arrangement. The orientation of the papers in the conference was not to the specialist in the field of the speaker, but to workers in all the other fields presented at the conference for their general backgrounds to aid in solving water management, policy, and planning problems. (K-napp-USGS) napp-USGS W69-03540

4C. Effects on Water OF Man's Non-Water **Activities**

DEPARTMENT OF NATURAL RESOURCES.

For primary bibliographic entry see Field 06E. For abstract, see . W69-03256

DUTIES OF THE DEPARTMENT OF PUBLIC WORKS RELATIVE TO COMMONWEALTH LANDS, CERTAIN ISLANDS, AND PROPERTY IN PLYMOUTH.

Mass Ann Laws, ch 91, secs 2, 2A (1967).

Descriptors: *Massachusetts, *Legislation, Islands, Administrative agencies, Shores, Tidal waters, Grants, Encroachment, Navigation, Riparian rights, Great ponds, Piers, Tourism, Recreation facilities, State jurisdiction, *Public lands.

The Department of Public Works of Massachusetts has charge, except as otherwise provided, of rights in lands, flats, shores, and tide waters belonging to the commonwealth. The department must ascertain the rights of the commonwealth in such property, and its extent and location. The department must prevent encroachment and trespass against the commonwealth's property. It may sell and convey, lease, or improve such lands for the benefit of the commonwealth if it will not impair navigation or riparian rights. The department also has charge of the lands, pier, structures, and other property belonging to the commonwealth in the town of Plymouth, which were acquired, built or improved by the Pilgrim tercentenary commission. All conveyances, contracts, and leases for more than five years, made under this section, shall be subject to the approval of the governor and council. (Watson-Ital) Fla) W69-03258

POWERS OF THE DEPARTMENT OF PUBLIC WORKS AS TO PR PORT OF BOSTON HAR-

For primary bibliographic entry see Field 04A. For abstract, see . W69-03259

POTENTIAL IMPACT OF FOREST FERTILIZA-TION ON RANGE, WILDLIFE, AND WATERSHED MANAGEMENT,
Southeastern Forest Experiment Station, Franklin,

J. B. Hilmon, and J. E. Douglass.

Proc Symp on Forest Fertilization, Apr 1967, Gainesville, Fla TVA Nat Fert Dev Cntr, Muscle Shoals, Ala, 1968. pp 197-202.

Descriptors: *Wildlife habitat, *Land use, *Forestry, Ecology, Ecosystems, *Fertilization, Watershed management, Water chemistry, Water

Identifiers: *Forest fertilization.

Increasing demands for water, forage and wildlife have increased emphasis on multiple-use manage-ment of forest lands. Such management requires a much fuller understanding of the forest ecosystem and the effects which disturbances such as fertilization have on it. This paper reviews some of the uon have on it. Ihis paper reviews some of the potential impacts of forest fertilization on forage, wildlife and water and is based primarily on results of recent research at Fort Myers, Florida; Tifton, Georgia; and the Coweeta Hydrologic Laboratory, Franklin, North Carolina. W69-03383

C AND W COAL CORPORATION V SALYER (DESTRUCTION OF UNDERGROUND STREAM).

200 Va 18, 104 SE 2d 50-55 (1958).

Descriptors: *Virginia, *Underground streams, *Percolating water, *Water law, Judicial decisions, Mining, Strip mines, Subsurface drainage, Subsurface streams, Water sources.

Plaintiff owned land adjacent to defendant's open pit coal mine. Plaintiff sued for damages for destruction of a strema on her property allegedly caused by defendant's mining operations. The stream was fed from some underground source. stream was fed from some underground source. Evidence showed that the strata of coal being mined near plaintiff's property started downward toward plaintiff's premises; and underground water flowed with the slant of the strata. The court ruled that unless it could be shown that the underground water flowed in a defined and known channel, it would be presumed to be percolating water. Per-colating waters are those which ooze, seep, or filter through the soil beneath the surface either without a defined channel or in a course that is unknown and not discoverable without excavation. Since defendant could not, in this case, have ascertained the existence, location, and flow of the underground stream by a reasonable examination of the surface of the earth, the court held that no liability obtained. (Scott-Fla) W69-03444

URBAN WATER RESOURCES RESEARCH: UNBAN WATER RESOURCES RESEARCH;
SYSTEMATIC STUDY AND DEVELOPMENT
OF LONG-RANGE PLANS, FIRST YEAR REPORT, SEPTEMBER, 1968.
American Society of Civil Engineers, New York.
Urban Hydrology Research Council.
For primary bibliographic entry see Field 06B.
For abstract see

For abstract, see . W69-03506

NORTHWOOD GAGING INSTALLATION, BAL-TIMORE-INSTRUMENTATION AND DATA, American Society of Civil Engineers Program Office, Cambridge, Mass. For primary bibliographic entry see Field 02E. For abstract, see . W69-03507

OAKDALE **GAGING** OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA. American Society of Civil Engineers Program Office, Cambridge, Mass.

For primary bibliographic entry see Field 02E. For abstract, see .

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS. Florida Univ., Gainesville. Dept. of Environmental

Engineering. For primary bibliographic entry see Field 07A. For abstract, see .

A CRITICAL REVIEW OF METHODS OF MEA-SURING DISCHARGE WITHIN A SEWER PIPE,

Illinois Univ., Urbana. For primary bibliographic entry see Field 07B. For abstract, see . W69-03510

THE NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR IMPORTANCE IN THE DECADES AHEAD,
American Society of Civil Engineers Program Office, Cambridge, Mass.

W69-03509

fice, Cambruge, Mass.
M. B. McPherson.
ASCE Tech Mem No 5, Urban Water Resources
Res Program, Dec 1968. 18 p, 3 tab, 23 ref.
OWRR: 14-01-0001-1585, USGS: 14-08-0001-

Descriptors: *Urbanization, *Urban sociology, *Water resources development, Social aspects, Drainage systems, Human population, Land use, Sewers, Utilities, Water utilization, Water supply, Aesthetics, Water reuse, Water quality. Identifiers: Urban hydrology.

Urban changes, largely social and economic, that affect urban hydrology are discussed in a survey and bibliography of urban sociology and recent urban history largely consisting of quotations and reviews of non-engineering and non-hydrological literature. Urban expansion is considered largely a function of development of new forms and trends of use of high-speed urban transport; one important period of growth was associated with development of streetcar systems and another with the personal automobile. The urban areas of the country are growing rapidly with trends of increasing urbanization added to increasing growth of suburbs. Urban growing rapidly with trends of increasing urbaniza-tion added to increasing growth of suburbs. Urban problems of crowding, water supply, waste disposal, and general environmental quality are growing even faster than the cities. The need for growing even faster than the cities. The need for comprehensive planning rather than solving single problems such as waste disposal or water supply is stressed. The environment of cities is a function of all social and physical factors. Hydrological problems can be solved only as part of the total environmental problem. (Knapp-USGS)

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILA-TION OF BASIC DATA-1966, Geological Survey, Austin, Tex. S. L. Johnson.

Prepared in cooperation with City of Houston, Tex. Geol Surv Duplicated Basic-Data Rep, 1968. 275 p, 13 fig, 12 tab, Charts, Hydrographs.

Descriptors: *Data collections, *Urbanization, *Hydrologic data, *Texas, Rainfall, Runoff, Stream gages, Hydrographs, Streamflow. Identifiers: Houston (Texas).

Basic data of the urban hydrology of Houston, Texas, 1965-66, are compiled. Surface-water records are from gaging stations, crest-stage partial-record stations, rain gages, and miscellaneous sites. Each gaging-station record includes location, drainage area, gage type and history, average discharge, extremes, remarks, daily discharge, total discharge, mean discharge, annual maximum, minimum, and mean discharges, and peak discharges. Runoff and rainfall are computed for each drainage basin and

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

hydrographs and mass curves are drawn. A map of each basin shows locations of all gages. (Knapp-USGS)

THE ROLE OF MAN IN ESTUARINE PROCES-

American Association for the Advancement of Science, Washington, D. C.
For primary bibliographic entry see Field 06G.

For abstract, see . W69-03638

4D. Watershed Protection

BLENDING FOREST USES.

Southeastern Forest Experiment Station, Asheville, N. C.; and Georgia Univ., Athens. School of

John D. Hewlett, and James E. Douglass.

U.S. Department of Agriculture, Forest Service, Research Paper SE-37, pp 1-15, July 1968. 15 p, 1 map, 9 photo, 1 dwg, 4 tab, 2 chart.

Descriptors: *Watershed management, Water yield improvement, Watersheds (Basins), Water sports, Appalachian Mountain Region, Forest management, Wildlife management, Recreation.

Identifiers: *Southern Appalachian Mountain Re-

Compatibility of forest management practices on a 356-acre Southern Applachian watershed is examined in this unique experiment to determine the feasibility of intensive management for wood, water, wildlife, and recreation. An efficient and stable access system is stressed, and the effect of various woods practices on the four basic resources is rated. Increases are shown in water yield, game forage, quality timber growth, and general use of the area. Some unresolved conflicts among uses of the forest are revealed. W69-03404

05. WATER OUALITY MANAGEMENT AND **PROTECTION**

5A. Identification **OF Pollutants**

INSECTICIDES IN TILE DRAINAGE EF-

FLUENT, California Univ., Los Angeles. Dept. of Engineering; California Univ., Los Angeles. Water Resources Center; and California State Dept. of Water Resources, Fresno.

William R. Johnston, F. T. Ittihadieh, and Kenneth

William 1. Wall of the control of th

Descriptors: *Insecticides, *Chlorinated hydrocarbon pesticides, *Drainage systems, Irrigation, California, Pesticide residues, Adsorption, Soils, Groundwater, Surface waters.
Identifiers: San Joaquin Valley (California), Irriga-

Drainage effluent from systems located on irrigated land in the San Joaquin Valley of California was analyzed for insecticide residues. Only relatively analyzed for insecticide residues. Only relatively small quantities of chlorinated hydrocarbon residues were found in tile drainage effluent, but higher concentrations were found in effluent from open drains where both surface and subsurface drainage waters were collected. Traces of residue were found in the irrigation water applied to tile drained farms. When the concentration factor, the ratio of depth of irrigation water applied to depth of drainage water removed on a unit basis is considered, the total quantity of insecticide residue in tile drainage effluent does not exceed and is generally less than the total quantity of residue applied in the irrigation water. Tailwater or surface runoff contained from 7 to 12 times as much residue as the applied water when DDT was applied to the land and as much as 85 times more residue to the land and as much as 35 times more residue than the irrigation water when Lindane was applied to the land. Relatively large concentrations of residue were found in the surface soil of the area studied, even where no pesticides had been applied directly to the soil. (Knapp-USGS) W69-03221

AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERIALLY SPRAYED WATERSHED SUBBASIN,

Federal Water Pollution Control Administration, Corvallis, Oreg., and Astoria Department of Public

Works, Oreg.
For primary bibliographic entry see Field 05B. For abstract, see . W69-03226

THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL, Southeast Water Lab., Athens, Ga.

D. R. Cochrane, J. D. Pope, Jr., and H. P.

Water Resources Res, Vol 3, No 2, pp 517-523, 1967. 7 p, 2 fig, 6 tab, 1 ref.

Descriptors: *Pesticides, *Herbicides, *Aquatic weed control, *Pesticide residues, *Adsorption, Hydrolysis, Soils, Leaching. Identifiers: *Silvex, *Hydrosoils.

The propylene glycol butyl ether ester of silvex, an herbicide useful to control aquatic plants, hydrolyzed almost totally to silvex acid in about two weeks when applied at the rate of 8 lbs/acre (acid equilvalent) to water overlying Cecil sandy clay loam, Lakeland loamy fine sand, and Brighton muck soils, in plastic pools. Silvex acid increased in concentration in water for a week and then dissipated gradually over a 19-week period. Apparent adsorption of both the ester and acid occurred on the hydrosoil and was followed by gradual diminution of both. Laboratory studies confirm that silvex acid can be adsorbed by the three soils. The possibility exists that silvex acid and/or a degradation product may be desorbed and readmitted to water. (Knapp-USGS)
W69-03240

THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,

Geological Survey, Denver, Colo. R. L. Wershaw, M. C. Goldberg, and D. J.

Pinckney.

Water Resources Res, Vol 3, No 2, pp 511-516, 1967. 6 p, 3 fig, 1 tab, 23 ref.

Descriptors: *Pesticides, *Surface waters, *Groundwater, *2-4 D, *Ionization, Pesticide residues, Pesticide kinetics, Pollutants, Water pol-

lution sources.
ldentifiers: *Ionization Constant, Kohlraush

The literature on the degradation of 2,4-D in water is reviewed and discussed, and a new determination of its ionization constant in water is presented. The compound 2,4-D (2,4-diclorophenoxyacetic acid) is the most widely used herbicide in the United States, and its widespread use may result in the applied compounds being carried or washed into nearby water courses, rivers, lakes, or groundwater reservoirs. Studies by various authors show that 2,4-D degrades within several weeks in soils; it can persist for up to 6 months or more in natural waters. The ionization constant of 2,4-D was redetermined at 25 deg C from conductivity measurements. A value for the ionization constant of 0.001169 was calculated when the equivalent conductivity measurements. ductance at infinite dilution of 2,4-D was computed from the equivalent conductance at infinite dilu-tion of the sodium salt of 2.4-D, using the Kohlraush method of independent ion mobilities. These results differ from those obtained by other workers, who computed the equivalent conductance at infinite dilution of 2,4-D, using the equations derived by Fuoss and his co-workers for the conductance of strong electrolytes in polar solvents. (Knapp-USGS) W69-03241

THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS, Massachusetts Univ., Amherst.

For primary bibliographic entry see Field 05B. For abstract, see . W69-03312

STUDIES OF THE ANALYSIS PHOSPHATES IN ALGAL CULTURES,

Wisconsin Univ., Madison. Water Chemistry Lab. G. Fred Lee, Nicholas L. Clesceri, and George P. Fitzgerald.

Int J Air Water Pollution, Vol 9, pp 715-722, 1965. 8 p, 1 fig, 5 tab, 8 ref.

Descriptors: *Algae, *Analytical techniques, *Cycling nutrients, *Eutrophication, *Phosphates, *Physiological ecology, Aquatic algae, Aquatic microbiology, Chlorophyta, Cyanophyta, Essential nutrients, Environmental effects, Nitrogen compounds, Nutrient requirements, Phosphorus compounds, Phosphorus, Phytoplankton.

Total phosphate analysis procedures were evaluated. It was found that the Standard Methods (1960) procedure of acid hydrolysis in 1 ml sulfuric acid (30%) was suitable for pyrophosphates and tripolyphosphates but not for total phosphate analysis of the academic was a chief of the Cold and Cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the standard was a chief of the cold and the c ysis of algae or algal extracts. Ashing (600 deg C, 1 hr), perchloric acid digestion (sulfuric acid plus pitrie acid plus acid plus pitrie acid plus acid plus pitrie acid plus acid plus acid plus pitrie acid plus aci hr), perchloric acid digestion (surfur acid plus nitric acid digestion gave satisfactory results. Supernatants from the green alga Chlorella pyrenoidosa (Wis 2005) did not affect orthophosphate analyses, but a consistant error (loss) was found when the supernatant of the blue-green alga Microcystis aeruginosa (Wis 1036) was tested. (Eichhorn-Wis) W69-03358

THE EFFECT OF ALGAE ON BOD MEASURE-

Wisconsin Univ., Madison. Hydraulic Lab., and Wisconsin Univ, Madison. Sanitary Lab.

George P. Gitzgerald.

J Water Pollution Control Fed, Vol 36, No 12, pp 1524-1542, Dec 1964. 19 p, 7 fig, 4 tab, 18 ref. Engineering Experiment Station Reprint No. 728.

Descriptors: *Biochemical oxygen demand, *Chlorella, *Photosynthetic oxygen, Algae, Analytical techniques, Aquatic algae, Aquatic bacteria, Aquatic microbiology, Bioassay, Chlorophyta, Cyanophyta, Environmental effects, Bioassay, Chlorophyta, Cyanophyta, Environmental effects, essential nutrients, Freeze drying, Freeze-thaw tests, Harvesting of algae, Nuisance algae, Nutrient requirements, Physiological ecology, Phytoplankton, Sewage bacteria, Sewage treatment, Water pollution, Water pollution control, Water pollution effects, Water pollution treatment.

The 5-day, 20 deg C BOD of the green alga Chlorella pyrenoidosa (Wis 2005) was compared when the algae had been grown in different culture media. The relative growth and relationships between growth measurements are presented. The activity of chlorella in BOD tests was independent of the volume of settled sewage seed. Algae from pure cultures seaded with sewage bacteria; the BOD of cultures seaded with sewage bacteria; the BOD of cultures seaded with sewage bacteria; the BOD of cultures pure cultures had the same BOD as algae from cultures seeded with sewage bacteria; the BOD of culture supernatants was decreased to one-fifth by bacteria added to the cultures. Dead algae had 4 times the BOD of live algae. Oxygen produced by algae after 2-hr incubation in light was used to follow the photosynthetic capacity of algae during incubation tests in the dark for as long as 16 days.

Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A-Identification of Pollutants

Chlorella could still produce oxygen after 16 days in the dark and for at least 7 days after the BOD bottles became anaerobic. The BOD of chlorella bottles became anaerobic. The BOD of chlorella varied between 0.09 and 0.19 mg oxygen used per milligram (dry weight) of suspended solids per liter for 5 days at 20 deg C. The results for algae from different culture media and different species are presented. (Eichhorn-Wisc) W69-03362

COPPER IN LAKE MUDS FROM LAKES OF

THE MADISON AREA,
Wisconsin Univ., Madison. State Lab. of Hygiene. M. Starr Nichols, Theresa Henkel, and Dorothy

Trans Wis Acad Sci Arts Lett, Vol 38, pp 333-350, 1946, 18 p, 6 fig, 9 tab, 4 ref.

Descriptors: *Lakes, *Mud, *Copper, Copper sulfate, Algal control, Algicides, Trace elements, Cores, Wisconsin, Bottom sediment, Benthic fau-

Identifiers: *Madison (Wis), Nuisance odors, Lake Mendota (Wis), Lake Monona (Wis), Lake Wingra (Wis), Lake Kegonsa (Wis), Lake Waubesa (Wis), Precipitation.

The amount of copper sulfate applied annually from 1925-1944 to Madison, Wis, lakes is given. Much of the copper sulfate added to lake waters of notable alkalinity was precipitated as a basic copper compound. From Lake Mendota, Lake Monona, Lake Wingra, Lake Waubesa and Lake Kegonsa the bottom muds at various water depths were analyzed for total and soluble copper. Core samples of lake muds from the various lakes were also taken. Lake Monona has received copper sulfate treatment for algal control for a much longer period than the other lakes, and this is reflected in the higher concentrations of copper found in the layers of mud of Lake Monona. The greatest concentration of copper is found in the deeper part of the lake. The copper content of the Lake Monona core penetrated to a depth of 8 feet. Action by burrowing fauna may have caused mixing of the upper layers to this depth. It appears that by far the greatest amount of copper applied remains as a deposit in the mud of the lake. (Eichhorn-Wisc) W69-03366

THE EFFECT OF DILUTION MEDIA ON THE

BOD OF ALGAE,
Wisconsin Univ., Madison. Hydraulic Lab; and
Wisconsin Univ., Madison. Sanitary Lab.
Mary M. Allen, George P. Fitzgerald, and Gerard

Mary M. Alleli, George T. L. A. Rohlich.
Engineering Experiment Station Reprint No. 697. J
Water Pollution Control Fed, Vol 36, No 8, pp
1049-1056, Aug 1964. 8 p, 3 tab, 11 ref.

Descriptors: *Biochemical oxygen demand, *Photosynthetic oxygen, *Chlorella, Algae, Analytical techniques, Aquatic algae, Aquatic bacteria, Aquatic microbiology, Bioassay, Chlorophyta, Cyanophyta, Diatoms, Environmental effects, Essential nutrients, Harvesting of algae, Nuisance algae, Nutrient requirements, Physiological polygen, Physiological properties, Physiological propertie cal ecology, Phytoplankton, Sewage, Sewage bacteria, Sewage treatment, Water pollution, Water pollution control, Water pollution treatment.

The 5-day, 20 deg C BOD of Chlorella pyrenoidosa (Wis 2005) averaged 0.11 mg of oxygen used per milligram of algae when tested in BOD dilution water but was 0.25 mg of oxygen used per milligram of algae when tested in fresh lake water. The photosynthetic capacity (milligrams of oxygen produced in 2 hours in light per milligram of algae) of algae incubated 5 days in the dark in lake water was nearly the same as algae incubated in dilution water. The addition of major or minor nutrients and added buffer capacity to standard dilution water did not increase the algal BOD. The organisms present in lake waters had little effect on algal BOD. When BOD was measured in algal culture

medium, the same rate as in dilution water was obtained. Deionized lake water made up to standard dilution water gave same BOD of algae as in dilution water prepared with distilled water. It is con-cluded that some heat-stable factor that cannot pass through ion exchange column affected the algal BOD or that the natural ratios of ions in lake waters are essential for maximum activity of algae in BOD. (Eichhorn-Wisc) W69-03371

EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS PHOSPHORUS IN ALGAE,

Wisconsin Univ., Madison. Water Chemistry Lab; and Wisconsin Univ., Madison. McArdle Memorial

George P. Fitzgerald, and Thomas C. Nelson. Engineering Experiment Station Reprint No. 909. J Phycol, Vol 2, No 1, pp 32-37, 1966. 6 p, 1 fig, 2 tab, 33 ref.

Descriptors: *Analytical techniques, *Bioassay, *Enzymes, *Nutrient requirements, *Phosphorus *Enzymes, *Nutrient requirements, *Phosphorus compounds, Algae, Aquatic algae, Aquatic microbiology, Aquatic productivity, Aquatic weeds, Chlorophyta, Cyanophyta, Diatoms, Cycling nutrients, Environmental effects, Essential nutrients, Nutrients, Phosphorus, Phosphates, Physiological ecology, Phytoplankton, Rooted aquatic plants, Eutrophication.

An extractive procedure for detection of surplus-An extractive procedure for detection of surplus-stored phosphorus (luxury consumption) in algae and an enzymatic analysis for conditions of phosphorus-limited growth in algae have been eval-uated. A simple 60-min boiling water extraction of algae known to contain surplus phosphorus separates essential phosphorus compounds and surplus-stored phosphorus compounds. Surplus phosphorus compounds can be measured in the exphosphorus compounds can be measured in the extract as orthophosphate. Extracts of algae limited in their growth by the amount of available phosphorus contain little or no orthophosphate. Limitation of algal growth by phosphorus supply induces the enzyme alkaline phosphatase. The activity of this enzyme can be measured at pH 9 using phosphorus interphysical phosphorus ty of this enzyme can be measured at pH 9 using phosphorus-nitrophenylphosphate as substrate. Algae which were phosphorus-limited and contained no extractable orthophosphate have as much as 25 times more alkaline phosphatase activity than algae with surplus available phosphorus. Comparative results are presented of extract and enzyme analyses of 9 species of algae from laboratory cultures and algae from 3 lakes before and after incubation in limiting or surplus phosphorus in the laboratory. Concentrations of more than 0.08 mg phosphate-phosphorus per 100 mg of algae extracted indicate algae contained surplus phosphorus. (Eichhorn-Wisc) W69-03373

SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON A NATIONAL SCALE, For primary bibliographic entry see Field 05G. For abstract, see . W69-03584

'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY POLLUTION', Stanford Univ., Calif. David A. Bella, and William E. Dobbins. PROCEEDINGS OF THE NATIONAL SYMPOSI-UM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 612-645.

Descriptors: *Mathematical models, *Dissolved oxygen, *Waste assimilation, Biochemical oxygen demand, Mathematical studies, Model studies.

One dimensional dynamic model for describing the mass balance in an estuary is described. It is shown that the resulting differential equations are too complicated for analytical solution. Numerical solution techniques are presented. W69-03690

5B. Sources of Pollution

CONVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN RELATION TO SUBSURFACE THE PROTECTION OF FROM CONTAMINATED WATERS DISCHARGES.

DISCHARGES, F. M. Bochever, and A. Ye. Oradovskaya. Transl from Doklady Vodgeo, No. 13, pp 159-180, 1966. Soviet Hydrol: Selec Pap, Issue No 4, pp 416-431, 1967. 16 p, 5 fig, 1 tab, 17 ref.

Descriptors: *Diffusion, *Porous media, *Groundwater movement, *Path of pollutants, Injection-wells, Waste disposal, Subsurface waters. Identifiers: USSR, Radial diffusion equations.

Methods are given for calculation of radial solute diffusion allowing for sorption in porous media. Examples of such diffusion are found near subsurface waste injection wells. Solutions are developed for varying and unvarying concentrations of injected fluids. (Knapp-USGS) W69-03212

FATE OF DDT AND NITRATE IN GROUND

Robert S. Kerr Water Research Center, Ada, Okla.: and Southwestern Great Plains Research Center, Bushland, Tex.

Marion R. Scalf, Victor L. Hauser, and Leslie G. McMillion.

Rep, April 1968. 46 p, 29 fig, 3 tab, 33 ref.

Descriptors: *Artificial recharge, *Nitrates, *DDT, Pesticides, Groundwater movement, Aquifers, Inection, Tritium, Tracers, Groundwater, Texas Identifiers: *Contaminant movement, Contaminant retention

Knowledge of the movement, degradation, and disappearance of toxic materials in an aquifer being artificially recharged is of vital importance. Data are presented on the movement, adsorption, and release of nitrate and DDT under actual recharge conditions in the Ogallala Aquifer at Bushland, Texas. Specific concentrations of tritiated water (used for tracer), DDT, and nitrate were added to the recharge water taken from an irrigation well 2,280 feet from the recharge point. Chemical and hydrologic parameters were continually measured at the recharge and nearby observation wells during the 10-day recharge period and the subsequent 12-day withdrawal period. The amount of tritium recovered demonstrated that 94 percent of the recharge water was recovered. Nitrate loss due to denitrification was not evidenced. However, the behavioral pattern at the observation wells indicated the movement of nitrate was not the same as that of the tritiated water. The DDT apparently was adsorbed to the aquifer material close to the recharge well, because no significant amounts reached the observation well 33 feet away. The DDT concentration in the pumped water was 16 times the recharge concentration during the first hour of pumping, but then decreased to below the recharge concentration. Concentrations after two days of pumping became erratic, apparently as a result of disturbances in the aquifer structure. Apparently, a major portion of DDT introduced during recharge was not recovered during pumping but remained in the aquifer. (Steinhilber-USGS) W69-03219

INSECTICIDES IN TILE DRAINAGE EF-

INSECTICIDES IN TILE DRAINAGE EF-FLUENT, California Univ., Los Angeles. Dept. of Engineer-ing; California Univ., Los Angeles. Water Resources Center; and California State Dept. of Water Resources, Fresno. For primary bibliographic entry see Field 05A. For abstract, see. W69-03221

Sources of Pollution—Group 5B

AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERI-ALLY SPRAYED WATERSHED SUBBASIN,

Federal Water Pollution Control Administration. Corvallis, Oreg., and Astoria Department of Public

Works, Oreg.
Richard B. Marston, Donald W. Schults, and
Tamotsu Shiroyama.
Pesticides Monit J, Vol 2, No 3, pp 123-128, Dec 1968. 6 p, 4 tab, 10 ref.

Descriptors: *Herbicides, *Water sources, *Pesticide kinetics, *Municipal water, Weed control, Spraying, Path of pollutants, Persistence. Identifiers: *Amitrole.

The herbicide amitrole, aerially sprayed on 100 acres of a subbasin in the Astoria, Oreg., watershed in a silvicultural attempt to control salmonberry, was found in measurable amounts in samples of water near the downstream edge of the sprayed area during and for 5 days after spraying. The maximum concentration of 155 ppb was found 30 min. after application began' however, it decreased to 26 ppb by the end of the 2-hr application and to non-detectable amounts by the sixth day after spraying. No amitrole was detected in the samples from a test station 1.8 mi below the sprayed area during or at any time after the spraying. (Knapp-USGS) W69-03226

EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,

Johns Hopkins Univ., Baltimore, Md. For primary bibliographic entry see Field 02J. For abstract, see . W69-03227

GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN NORTHEAST-ERN ILLINOIS,

EKN ILLINOIS, Illinois State Geological Survey, Urbana. Keros Cartwright, and Murry R. McComas. Ground Water, J Tech Div Nat Water Well Ass, Vol 6, No 5, pp 23-30, Sept-Oct 1968. 8 p, 8 fig, 11

Descriptors: *Landfills, *Waste disposal, *Path of pollutants, *Groundwater, Soil temperature, Resistivity, Water table, Groundwater movement, Il-

Identifiers: Winnetka (Ill), Woodstock, Elgin.

Electrical earth resistivity and soil temperature surveys were conducted in the vicinity of four sanitary landfills in northeastern Illinois to test the possibility of detecting and tracing any chamical or temperature alteration of groundwater by leachates from buried refuse. Reference data on water quality, levels, and movement were provided by a system of monitor wells drilled for a hydrogeologic study of the landfills. The resistivity survey in study of the landfills. The resistivity survey in homogeneous silty sand outwash traced mineral-ized water from the landfill for a distance of more than 1,000 feet. Apparent resistivity values were one fourth those obtained from unaffected areas. one fourth those obtained from unarfected areas.
Interpretations of groundwater flow and location of discharge boundaries from the geophysical data agree with interpretations based on the monitor well data. The soil temperature survey indicate the presence of a halo of higher temperatures around the landfill and indicated areas of surface recharge. The geophysical surveys show, in general, that chemically altered water is traceable in uniform earth materials where the depth of the water table is constant. (Knapp-USGS) W69-03236

NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,

Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab. Uri Y. Shamir, and Donald R. F. Harleman. Water Resources Res, Vol 3, No 2, pp 557-581, 1967. 25 p, 14 fig, 2 tab, 19 ref.

Descriptors: *Dispersion, *Diffusion, *Porous media, *Groundwater movement, *Water pollution, Path of pollutants, Digital computers, Computer programs.

dentifiers: Numerical methods.

A numerical method is presented for the solution of problems of dispersion in steady 3-dimensional potential flow fields in porous mediums, in which the miscible fluids have the same density and viscosity. The method is developed and tested for 2-dimensional problems, and the extension to 3 dimensions is presented. Emphasis is put on the efficiency of the numerical scheme and on its generality. It is shown to be independent of the geometry of the flow field. The computer program for carrying out the computations as described is tested with simple problems, for which exact or approximate analytical solutions exist. It is also used to obtain solutions to a few problems for which no other solution is known. (Knapp-USGS) W69-03237

HYDROLOGIC DATA COLLECTION IN TIDAL

ESTUARIES, Federal Water Pollution Control Administration, Cincinnati, Ohio.

For primary bibliographic entry see Field 02L. For abstract, see . W69-03239

THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL, Southeast Water Lab., Athens, Ga.

For primary bibliographic entry see Field 05A. For abstract, see . W69-03240

THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 05A. For abstract, see . W69-03241

DISCHARGE OF OIL ON SURFACE WATERS -DOUBLE TORT LIABILITY FOR DAMAGES.

Mass Ann Laws ch 91, secs 59, 59A (1967).

Descriptors: *Massachusetts, Legislation, Water law, *Water pollution, Tidal waters, Rivers, Oil, *Oil wastes, Oily water, Insects, Mosquitoes, *Damages, Lakes.
Identifiers: Bilge water.

It is unlawful to discharge oil into or on the waters of any lake, river, tidal waters, or flats of the Com-monwealth of Massachusetts if the discharge constitutes a pollution or contamination of the waters, a nuisance, or is injurious to the public health. Any person violating this section may be fined up to \$500. This section is not construed to prohibit the use of oil for the extermination of mosquitoes or other insects. Any person who violates this section damages to the person whose property is damaged. (Watson-Fla)
W69-03274

DUNLAP LAKE PROPERTY OWNERS ASS'N, INC V CITY OF EDWARDSVILLE (ABATEMENT OF POLLUTION).

22 Ill App 2d 95, 159 NE 2d 4-6 (1959).

Descriptors: *Illinois, *Bypasses, *Sewers, *Pollution abatement, Judicial decisions, Local governments, Sewage districts, State governments, Sanitaments, sewage districts, State governments, Santa-ry engineering, Disposal, Effluents, Public health, Sewage, Waste water (Pollution), Lakes, Storm drains, Sewerage, Damages, Water pollution, Water pollution sources, Administrative agencies.

Plaintiff, a non-profit corporation, sued to enjoin defendant from further using a sanitary sewer by-pass which allegedly caused sewage to flow into a private lake. The lake was used by area residents for all household purposes, including drinking, as well as for swimming and boating. The by-pass is part of the city's combined storm sewer and sanitary sewer system. When the level in the sanitary sewer reaches a certain height at the point of a bypass because of a stoppage or an overloading caused by heavy rain, the sanitary sewer overflows into the storm sewer; at one particular by-pass, the storm sewer empties into a natural watercourse or ditch which, in turn, empties into plaintiff's lake. The injunction was denied, because plaintiff had not demonstrated actual and substantial injury. The court held that speculative or anticipated damage, as shown in the instant case by plaintiff, is not properly the subject of a permanent injunction proceeding brought by individuals. While plaintiff had shown that the defendant had created a condinad shown that the defendant had created a condi-tion whereby diluted sewage could, on infrequent occasions, flow into plaintiff's lake, there was no actual evidence of pollution. The court concluded that pollution control and abatement are best left to the appropriate specialized state agency, except in cases of flagrant and obvious pollution. (Scott-W69-03278

STEARNS V STATE (DIVERSION OF SEWAGE EFFLUENT INTO CLEAN RIVER BY ORDER OF ADMINISTRATIVE AGENCY). 274 Wisc 101, 79 N W 2d 241-246 (1956).

Descriptors: *Wisconsin, Judicial decisions, Water Descriptors: *Wisconsin, Judicial decisions, Water law, *Administrative agencies, Water pollution, *Eminent domain, Rivers, *Sewage disposal, Urbanization, Legal aspects, Sewage effluents, Sanitary engineering, Municipal wastes, Diversion, Ditches, Damages, Legislation, Cities, State governments.

The Wisconsin Committee on Water Pollution ordered the Madison Metropolitan Sewerage District to submit plans to eliminate the discharge of sewage effluent into certain lakes in the Madison area. Pursuant to the order, the district submitted plans to divert the effluent into a creek and river plans to divert the efficient find a creek and river which bordered the plaintiff's property. The plain-tiff protested the decision of the district. The trial court and the Supreme Court of Wisconsin af-firmed the decision of the district holding that the evidence supported the decision. The supreme court stated that as industrial and urban communities grow, the need to dispose of wastes necessarily invades the property rights of the surrounding peo-ple. Although a Wisconsin statute prohibits water pollution, it is allowed if done pursuant to law. No mention was made of compensation to the landowners for lost riparian rights. (Watson-Fla) W69-03296

RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE WATER,

Colorado State Univ., Fort Collins.
J. F. Fair, and S. M. Morrison.
Water Resources Res, Vol 3, No 3, pp 799-803, 1967. 5 p, 2 tab, 5 ref. Grant WP-00679.

Descriptors: *Water quality, *Aquatic microbiology, *Pathogenic bacteria, *Wildlife, *Livestock, Salmonella, Potable water. Identifiers: Arizona group pathoginic organisms.

An investigation of the presence of enteric disease An investigation of the presence of enteric disease producing bacteria in a high quality mountain stream in Colorado yielded 11 isolants of members of the genus Salmonella and 51 isolants of organisms belonging to the Arizona group. An improved method for the recovery of these organisms from high quality water was developed and used successions. fully. The presence of these potentially pathogenic bacteria, which appeared to be the result of contamination by wild or domestic animals, may be a potential hazard to public health.

W69-03311

Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources of Pollution

THE OCCURRENCE AND CHARACTERISTICS

OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS, Massachusetts Univ., Amherst. Ward S. Motts, and Marvin Saines. Water Resources Research Center Publ No 7, Jan 1969, 70 p. OWRR Project A-004-Mass.

Descriptors: *Water quality, *Groundwater, *Massachusetts, Water pollution, Path of pullutants, Chlorides, Iron, Domestic wastes, Sewage. Identifiers: *Groundwater contamination.

The history of contamination of groundwater sup-plies in Massachusetts is reviewed and the present pulse in Massachuseus is reviewed and the present quality of water supplies is compiled and related to geomorphology, bedrock geology, and human ac-tivity. Geomorphic areas of groundwater discharge, including swamps and floodplains generally have including swamps and floodplains generally have greater percentages of iron, manganese, and low pH than areas of groundwater recharge. Four major hydrochemical facies in glacial-outwash and in alluvial aquifers correlate with bedrock geology: (1) a widespread acidic facies characterized by low pH and soft water with high iron and manganese;
(2) an alkaline facies of western Massachusetts and (3) of eastern Massachusetts both characterized by high pH and hard water; and (4) an alkaline facies of the Connecticut Valley characterized by high pH and mostly soft water. From 1850 to 1966, a 4 to 10-fold increase of chlorides in public water supplies occurred throughout the state, accompanied by an accelerated chloride increase from about 1954 through 1966. If this increase continues at the same rate, widespread aquifers that contain potable water could be in danger of becoming unusable. A major severe groundwater contamination problem of the state if high iron content that increases with depth in crystalline basement, occurs in many swamps, and is common where organic material is interbedded in sediments near discharge areas.

Corrosive water of low pH is a serious problem in some aquifers where organic material is present. Fecal pollution has occurred where rocks have fracture porosity as in the vicinity of the towns of Berlin and Granby, Massachusetts. W69-03312

THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN

John Hopkins Univ., Baltimore, Md. Chesapeake

For primary bibliographic entry see Field 02L. For abstract, see .

EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE, Wisconsin Univ., Madison. Water Chemistry Lab. G. P. Fitzgerald, and S. L. Faust. Engineering Experiment Station Reprint No. 995. Limnol Oceanogr, Vol 12, No 2, pp 332-334, April 1967. 3 p, 2 tab, 9 ref.

Descriptors: *Analytical techniques, *Cycling nutrients, *Eutrophication, *Phosphorus compounds, *Water pollution sources, Algae, Algal control, Algal poisoning, Algicides, Aquatic algae, Bioassay, Chiorophyta, Cyanophyta, Diatoms, Disinfection, Environmental effects, Essential nutrients, Freeze drying, Freeze-thaw tests, Inhibition, Nutrient requirements, Phosphorus, Phosphates, Physiological ecology, Phytoplankton.

Recommended methods for preserving water sam ples before analysis were used to demonstrate that if algae are not removed from the samples before preservation, phosphate will be released by treated algae. The amount of phosphate-phosphorus (in milligrams per 100 mg algae) released by different algal species varied from 0.01-0.017 for overnight agai species varied from 0.014.077 for overlight refrigeration at 3-5 deg C to 0.38-0.78 after 60-min extraction in boiling water bath. Freezing (-15 deg C) overnight, chloroform saturation, and an or-ganic mercury algicide also caused the release of phosphate-phosphorus. It is concluded that the release of phosphorus from algae could be significant unless the algae are removed before the samples are preserved for storage. (Eichhorn-Wisc) W69-03370

STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON FOREST LAND.

Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.

Logan A. Norris. Res. Prog. Rep., Western Soc. of Weed Sci. 1968:33-34.

Descriptors: *Water pollution, *Forest management, *Aminotriazole, *2-4 D, *2-4-5 T, Overland flow, Watershed management, Chemicals, Agricultural chemicals, Pesticides, Pesticide residues, Aquatic life.

Fall rains will not result in appreciable contamina-tion of streams flowing through forest areas treated with phenoxy or amitrole herbicides in spring or early summer. Unless heavy application is made directly to the stream, the major potential for stream contamination is from heavy rain or land movement resulting in heavy overland flow of water and sediment shortly after harbicides are applied. W69-03381

RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST WATERS.

Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
Robert F. Tarrant, and Logan A. Norris

(Residues in Forest Waters Proc. Herbicides and Vegetation Mgt. Symp., Oregon State Univ. (1967): 94-102.

Descriptors: *Herbicides, *Solvents, *Water pollution, *Forest management, Pesticides, Oil, 2-4-5 T, 1001, Porest management, Pestucides, Silva 2-4 D, Aminotriazole, Phenolic pesticides, Agricultural chemicals, Chemicals, Fish, Pesticide residues, Pesticide toxicity, Aquatic life, residues, Pesticide t Watershed management.

A summary of evidence from research indicates that many herbicides and their carriers, when used in a responsible manner, can be employed in forest vegetation control with minimum impact on water vegetation control with minimum impact on water quality. Carelessly applied chemicals can cause sig-nificant damage to water quality and aquatic organ-isms. Much of today's research in the field of herbi-cide use is directed toward developing new chemicals and techniques of use that will overcome past problems. Along with increased attention to improving chemical brush control practices, the concept of large-scale brush eradication itself needs reappraisal. W69-03397

GROWTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE AFTER FERTILIZER TREATMENTS,

Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
Robert F. Tarrant, and Roy R. Silen.
Reprint from Soil Sci. Soc. Amer. Proc. 1968, 30

(6):796-799, illus.

Descriptors: *Forest management, *Nitrogen compounds, *Phosphorus compounds, *Irrigation effects, Oregon, Soil contamination, Ponderosa pine trees, Soil chemistry, Soil improvement, Fertilizers, Nutrient requirements, Watershed management, Agricultural chemicals.

On a Deschutes loamy sand soil in central Oregon, height and diameter growth of irrigated young pon-derosa pine increased linearly as amount of N fer-tilizer was increased from 0 to 400 lb/acre. Addition of P fertilizer in various combinations with N either increased or decreased tree growth depending on rates used. However, even the unfertilized but irrigated trees, measured as controls in this study, grew much faster than unirrigated trees nearby.

After 6 years, soil that had received heaviest N applications contained little more N than did unfertilized soil. Soil that had received heaviest applica-tions of P had about 11% more N. The amount of P was not different between unfertilized soil and that receiving heaviest N treatment. However, in soil receiving heaviest P treatments the amount of soil was 91 lb/acre-more than 5 times that of unfer-W69-03398

CHEMICAL BRUSH CONTROL AND HERBI-CIDE RESIDUES IN THE FOREST ENVIRON-

Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.

... A. Norris.

Proc. Herbicides and Vegetation Mgt. Symp., Oregon State Univ. (1967):103-123.

Descriptors: *2-4 D, 2-4-5 D, *Aminatriazole, Fish, Chemicals, Agricultural chemicals, *Forest management, *Water pollution sources, Oregon, Watershed management, Pesticides, Pesticide residues, Aquatic life.
Identifiers: Amitrole.

As determined from monitoring studies in western Oregon, the use of herbicides on forest lands constitutes little or no threat to native fish populations or down-stream water users. In eastern Oregon, herbicide residue concentrations exceeded p.p.m. in a few instances, a concentration under which some short-term damage to fish might result. In most instances, however, the length of persistence was such that the hypothetical biologic safe limit was exceeded for only a few days at most. After forest spraying, some herbicide will appear in nearly all streams which flow by or through treated areas. Nearly all of this residue results from direct application of spray materials to water surfaces. The maximum concentration is a function of the proportion of the watershed treated, the amount of live stream included in the unit, the ratio of the surface area of the stream to its volume, and the degree to which brush overhanging the stream intercepts spray materials. The length of persistence is a function of the hydrologic nature of the area treated W69-03399

NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING,

Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg. Robert F. Tarrant, K. C. Lu, W. B. Bollen, and C.

S. Chen. Tellus 1968. XX (3):554-556.

Descriptors: *Chemistry of precipitation, Precipitation (Atmospheric), Organic compounds, *Sea spray, *Nitrogen compounds, Nitrogen cycle, *Rain forests, Ecology, Watershed management, *Chemistry

Identifiers: *Forest environment, Organic debris.

Precipitation was collected and analyzed in a Precipitation was collected and analyzed in a coastal Oregon forest opening from June 1963 through May 1964. Very little NO2-N or NO3-N was found, and no NH4-N was found at any time. Of the total N deposited in precipitation, 87 percent was in the organic form, the major source of which is believed to have been from pollen or other locally generated, airborne organic debris. The 1.49 kg/ha/year total N in precipitation did not constitute a significant accretion to the nitrogen economy of the forest ecosystem. (Author) W69-03400

PESTICIDES IN FOREST WATERS—SYMPTOM OF A GROWING PROBLEM, Pacific Northwest and Range Experiment Station, Corvallis, Oreg. For printing bibliographic entry see Field 05C.

For abstract, see . W69-03401

Sources of Pollution—Group 5B

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES, Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg. Robert F. Tarrant, K. C. Lu, W. B. Bollen, and C.

S. Chen.

USDA Forest Serv. Res. Pap. PNW-54, 1968. 7 pp.

Descriptors: Nitrogen compounds, *Cycling nutrients, Ecology, Chemicals, Rain forests, *Throughfall, Conifers, Douglas fir trees, *Stemflow, *Chemistry of precipitation, Oregon. Hydrogen ion concentration. Identifiers: Alder.

Concentration of NO ion was much greater in stemflow from conifers than in other precipitation-forest type combinations, and that of NH ion was substantially greater in alder stemflow and throughfall. Acidity of throughfall precipitation was not different from that of open-collected rainfall. Stemflow was always more acid than the other two forms of precipitation, but the ecological significance of this difference is not believed to be great. The role of precipitation in N-cycling in three coastal Oregon forest types appears to be minor in comparison with the much greater amounts of N cycled in litterfall.

W69-03402

POLLUTING STREAMS PROHIBITED.

NY Conservation Law sec 180 (McKinney 1968).

Descriptors: *New York, Legislation, *Water pollution, *Fish, Trout, Fish hatcheries, Fish conservation, Streams, Hudson River, Bodies of water, Legal aspects, Water pollution control, Sewage, Rivers, Pollutants, Fish toxins, Drainage. Identifiers: Mohawk River.

Section 180 provides pollution protection for fish. No sewage, drainage, deleterious or poisonous substances may be placed in any waters in such quantities as may be injurious to fish life and propagation, or injurious to the waters used by the state fish hatcheries. Vessels may not dump oil, acid, etc into the waters of the Hudson or Mohawk rivers. Further, no solid substances, except snow or ice, may be deposited in or on the banks of any stream inhabited by trout. (Sisserson-Fla) W69-03468

PROTECTION OF WATERS; CESSPOOLS AND

N Y Conservation Law sec 324 (McKinney 1968).

Descriptors: *New York, *Water pollution control, *Shellfish, *Sewage disposal, Legislation, Legal aspects, Drains, Commercial shellfish, Fish, Industrial wastes, Waste disposal, Bodies of water, Domestic wastes, Conservation, Cesspools. Identifiers: Vessels, Dumping.

No garbage, sludge, refuse, or sewage, from any vessel or building on land or water, which is injurious to the quality of shellfish or fish, shall be dumped, thrown, or allowed to run into the waters of the Marine District. (Sisserson-Fla) W69-03470

STATE V KINSLEY (VIOLATION OF POLLU-TION STATUTE).

103 N J Super 190, 246 A 2d 764-766 (1968).

Descriptors: *New Jersey, *Legislation, *Water pollution sources, *Landfills, Judicial decisions, Water pollution, Water pollution control, Legal aspects, Water pollution effects, State governments, Streams, Land development, Fish, Public health, Wildlife conservation, Birds.

efendant, as a result of his landfill operations, was charged with violation of a statutory prohibition of pollution of water. The statute made it unlawful to allow deleterious or poisonous substances to enter streams in quantities destructive of life or disturbing the habits of fish and birds inhabiting such waters. The municipal court found that defendant's landfill was the cause of the pollution, but held defendant not guilty because there was no proof of guilty knowledge. The county court reversed, and fined the defendant. The court said the statute involved was not criminal or quasi-criminal, but civil in nature, and, therefore, the state satisfied its burden of proof by providing the preponderance of the evidence. The court held that the statute involved was 'malum prohibitum,' which does not require knowledge or intent. (Wheeler-Fla) W69-03475

DRAINS AND PROTECTION OF PUBLIC WATER SUPPLIES. N Y State Sanitary Code Ch 6 reg 7, 8 (McKinney

1954).

Descriptors: *New York, *Watershed management, *Swimming pools, *Waste water disposal, Bodies of water, Lakes, Recreation facilities, Water supply, Public health, Legislation, Legal aspects, Administrative agencies, Reservoirs, Discharge (Water), Sewers, Drains, Regulation, Recreation

Regulation 7 requires that drainage from artificial swimming pools into sewers receiving domestic sewage must be discharged in such a manner that sewage cannot be siphoned, flooded, or otherwise introduced into the swimming pool. Regulation 8 states that swimming pools or bathing beaches located on the banks of a body of water used as a source of public water supply must be operated so as not to create a menace to such a supply. The rules enacted by the State Commissioner of Health to protect such water supplies shall be strictly observed. (Sisserson-Fla) W69-03476

THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS. N Y Public Health Law sec 1300-b (McKinney

1968).

Descriptors: *New York, *Sewage disposal, *Wastes, *Bodies of water, Public health, Streams, Sewer, Legal aspects, Poisons, Sediment discharge, Industrial wastes, Sewage, Water pollution sources,

Regulation, Legislation.
Identifiers: *Public waters, Offal, Gas tar, Misdemeanor.

A person who throws or deposits gas tar, offal, refuse or any other noxious, offensive, or poisonous substance into any public waters, or into any sewers or streams running into any public waters, is guilty of a misdemeanor. (Sisserson-Fla) W69-03477

RELATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN ALGAE, Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
Wallace H. Fuller, and James E. Hardcastle.
Reprint from Soil Sci Soc Amer Proc, Vol 31, No 6, pp 772-774, Nov-Dec 1967. 3 p, 2 fig, 2 tab.

Descriptors: *Soii algae, *Aquatic algae, Algae, Arid climates, Semiarid climates, *Absorption, *Calcium, Soil contamination, *Strontium radiosotopes, Cytological studies. Identifiers: Nutrient media.

Soil algae appear in abundance in arid and semiarid lands where they form surface crusts of varying density and cling to stone surfaces and lime outcrops. The uptake of radiostrontium by 7 freshwater and desert algae with respect to their function in concentrating radioactive contamination products of uranium fission was evaluated. In addition, the interrelationships between the uptake by

algae of strontium and calcium were studied. The objective was twofold: (1) to evaluate the capacity of certain arid land algae to distinguish between calcium and strontium in their metabolism, and (2) to evaluate the extent to which calcium enters into a competitive position in the absorption and con-centration of strontium by algae cells. Uptake always favored calcium over strontium when the two elements were present in nutrient media together thereby modifying the hazard of strontium entering the food chain. (Affleck-Ariz) W69-03491

IMPACT OF INSTITUTIONAL ARRANGE-MENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER AL-LOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,

Wash.; Battelle-Northwest, Richland, Northwestern Univ., Evanston, Ill. For primary bibliographic entry see Field 06A.

For abstract, see . W69-03492

INDUSTRIAL WASTE GUIDE ON THERMAL

Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab. Alden G. Christianson, and Bruce A. Tichenor. Fed Water Pollut Contr Admin Rep, 112 p, Sept 1968. 6 fig, 11 tab, 91 ref.

Descriptors: *Thermal pollution, *Pollution abatement, Industrial wastes, Thermal powerplants, Industrial production, Water pollution effects, Legal aspects, Water Pollution control. Identifiers: Thermal water pollution.

A guide to the sources, effects, and methods of A gaine to the sources, effects, and methods of control of thermal water pollution is presented to aid state, federal, and local regulatory personnel, community and regional planners, and industrialists in making sound decisions on handling hot discharges. A guide to more specific literature is included with a general description of the subject for the user's basic orientation. The general topics covered are heat loads from general industry, electric power, and manufacturing; physical, chemical, and biological effects; and methods of control and utilization of excess heat. A bibliography of 91 references is included. (Knapp-USGS) W69-03537

EFFECTS OF STREAMFLOW REGULATION ON WATER QUALITY-THE TVA EXPERIENCE,

Milo A. Churchill.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 118-131, 1968. 14 p, 11

Descriptors: *Water quality, *River regulation, *Reservoirs, *Tennessee Valley Authority Project, Conferences, Publications, Stream flow, Impoundments, Flood control, Thermocline, Stratification, Pollution, Dissolved oxygen, Biochemical oxygen demand, Water quality control, Thermal stratification, Impounded waters, Water storage. Identifiers: Bacteriological effects, Dissolved

minerals.

An understanding of the effects of impoundment on water quality is a prerequisite to sound planning for the conservation and development of water resources. A comprehensive body of knowledge has been assembled during 30 years of investigations of the changes in physical, bacteriological, chemical and other qualities of water produced by the TVA water control system. An understanding of themal stratification in reservoirs and its inof thermal stratification in reservoirs and its in-fluence is essential to understanding reservoir effects on the temperature of released water and on many other parameters of water quality. Storage impoundments have a marked effect on dissolved oxygen which in turn affects the capacity of water

Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources of Pollution

released from impoundments to assimilate organic wastes and to support aquatic life. Storage impoundments serve as barriers between upstream bacterial pollution and downstream sites of water use. In a storage reservoir, variations in mineral concentrations are lessened so that water of more uniform quality results downstream. The effects discussed are those of the large storage reservoirs. uscussed are those of the large storage reservoirs. The article also discusses the various effects on the same water qualities of small reservoirs used mainly for power. (Childs-Fla) W69-03585

TEXTILE WASTES - A BIBLIOGRAPHY,
North Carolina State Univ., Raleigh, Dept. of Tex-

North Carolina State Charly States of the Charles D. Livengood.
North Carolina Water Resources Research Inst.
Report No. 18, 1968. OWRR Project A-006-NC.

Descriptors: *Industrial wastes, *Textiles, Water pollution, *Bibliographies.

This annotated bibliography contains 482 literature entries published after 1954 relating to textile wastes. It includes abstracts published in the Chemical Abstracts, Textile Technology Digest, Shirley Institute Abstracts, and Water Pollution Abstracts through June 1968. Each entry has been Austracts through June 1968. Each entry has been key-word coded and indexed. Coding was made compatible with the Thesaurus of Engineering Terms published by Engineers Joint Council. W69-03597

BIOTIC RESPONSE TO POLLUTION REDUC-

TION IN A RIVER, Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.

For primary bibliographic entry see Field 05C. For abstract, see. W69-03602

THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS.

Johan A. Aalto.

Paper presented at Winter Meeting of the Interstate Commission on the Potomac Basin, Fredericksburg, Virginia, February 29, 1968.

*Statistics, *Water Descriptors: *Statistics, *Water quality, *Biochemical oxygen demand, *Dissolved oxygen, *Forecasting, *Water pollution, E. Coli, Data collections, Oxygen demand, Plants, Coliforms, Bacteria, Microorganisms, Maryland, Virginia, Geographical regions, Regions, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Northeast U. S., Southeast U. S.

The author presents information on water quality and pollution loads in the Upper Potomac Estuary. The total load is eight times the assimilative capacity required to maintain a dissolved oxygen (DO) average of five mg/1. The median counts per 100 ml at Woodrow Wilson Bridge were 91,000 MPN coliforms and 24,000 MPN fecal coliforms (E. Coli). Minimum dissolved oxygen levels for 1965 and 1985 are also given. W69-03603

'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES, Federal Water Pollution Control Administration,

Atlanta, Ga. Walter Abbott

Transcript of Public Meeting, Biloxi, Mississippi, January 17, 1968, pp 8-13.

Descriptors: *Mississippi, *Gulf of Mexico, *Economic justification, *Federal government, *Administration, Coastal plains, Geographical regions, Gulf coastal plain, State governments, Regions, Navigation, State jurisdiction, Governments, Eutrophication, Southeast U. S., Turbidity, Physical properties, Gulfs, Bodies of water, Surface waters, Waste water (Pollution), Liquids, Liquid wastes, Wastes, Water types.

From the standpoint of economics, the estuaries of Mississippi are best put to use as navigation chan-nels and open sewers, recognizing that pollution growth is inevitable. The author sees no justificagrowth is mevitable. The author sees no justifica-tion for federal intervention in the management of intrastate estuarine waters. Hypereutrophication concepts are derived from 'glacially formed, oligotrophic, northern lakes' which do not neces-sarily apply to Gulf of Mexico estuaries. He con-cludes, 'it would appear that decrease in fresh-water influx, with associated decrease in turbidity, probably constitutes a for greater hards. probably constitutes a far greater hypereutrophica-tion menace than does inflow of domestic and industrial waste waters'. W69-03605

POLLUTIONAL 'DISTRIBUTION OF LOADINGS IN SUISUN BAY'.

Stanford Univ., Calif.

Takashi Asano.
PROCEEDINGS OF THE NATIONAL SYMPOSI-UM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 441-461.

Descriptors: *Dye releases, *Dispersion, *Waste disposal, *Water quality, *California, Mathematical studies, Tracers, Water types, Analytical techniques, Tracking techniques, Flow, Inflow, Mixing, Geographical regions, Pacific coast region, Regions, Southwest U. S., Water pollution, Fresh

The California Department of Water Resources conducted a series of dye tracer studies during 1965 and 1966. The 1966 series was conducted jointly with the Federal Water Pollution Control Administration in the Lower Delta and Suisun Bay Administration in the Lower Delta and Susuan Bay and in the United States Army Corps of Engineers' San Francisco Bay Model. The waste dispersive characteristics under various flow regimes and the specific effect of fresh water inflow upon the dispersion and transit of continuously discharged pollutants into the study area were investigated. Coordination of the actual waste loadings and dispersive information with proposed mathematical expressions was examined to reproduce present and future water quality conditions.

W69-03609

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, Lewis M. Cadwallader. Committee on Public Works, U. S. Senate, Washington, D. C., April 17, 1968.

Descriptors: *Thermal pollution, *Cooling towers, *Maryland, *Thermal powerplants, *Pollution abatement, Electric powerplants, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Engineering structures, Industrial plants, Powerplants, Structures, Water pollution, Waste disposal, Abatement.

Cadwallader states the pros and cons of cooling towers in an estuary. There are five factors to be considered when placing cooling towers in an estuary: (1) They introduce large volumes of water vapor to the environment which can produce local fogging or icing; (2) They produce concentrated liquid wastes which are a disposal problem; (3) They are aesthetically unpleasing; (4) They present construction problems due to the corrosiveness of the salt and brackish waters on the materials used in their construction; and (5) Their salt-water vapors are potentially dangerous to nearby crops and vegetation.

W69-03619

'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',

PLANT DISCHARGES', Stanford Univ., Calif. John Eric Edinger, and John C. Geyer. In PROCEEDINGS OF THE NATIONAL SYM-POSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 462-485.

Descriptors: *Discharge measurement, *Equa-Descriptors: *Discharge measurement, *Equations, *Hydroelectric plants, *Water cooling, *Temperature control, Thermal pollution, Water pollution, Cooling towers, Cooling water, Water types, Cooling, Powerplants, Engineering structures, Industrial plants, Structures, Electric powerplants, Afterbays, Estuarine environments, Aquatic environments, Environment.

The temperature distribution resulting from the ad-The temperature distribution resulting from the advection, dispersion, and cooling of water from a steam-electric-powerplant condenser is analyzed for a station located on a peninsula and discharging near the midpoint of a small estuary. A theoretical temperature distribution equation is developed and used to predict within a mile of the discharge point for various levels of operation. Temperatures are related to an equilibrium temperature toward which water temperatures are driven meteorological conditions.

W69-03655

EQUIPMENT FOR A DIRTY JOB. Chemical Week, Vol 102, No 7, February 17, 1968, pp 69-81.

Descriptors: *Thermal pollution, *Equipment, Water pollution, Electric powerplants.

This article describes a variety of water pollution problems, as well as some equipment designed to alleviate these problems. With regard to thermal pollution, it is stated that electrical generating plants using nuclear or fossil fuels were among the first to be tagged as thermal polluters. However, a number of the process industries are also potential polluters, particularly if they are on small streams or form large industrial complexes that are highly geographically concentrated.

W69-03661 This article describes a variety of water pollution

METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY PROGRAM, C. V. Gibbs, and G. W. Isaac.

Water Pollution Control Federation, Journal, Vol. 40, No 3, March, 1968, pp 385-394.

Descriptors: *Monitoring, *Rivers, *History, *Water quality control, *Washington, Bodies of water, Running waters, Streams, Surface waters, Water pollution control, Control, Quality control, Geographical regions, Pacific coast region, Pacific northwest U. S., Regions, Data collections,

The Duwamish estuary study by the Municipality of Metropolitan Seattle is the most comprehensive municipally sponsored water quality study in the Pacific Northwest. The historical development of the river problem, present water quality-monitoring efforts, and results of the investigations are presented. Data collected will be used to guide the formulation of plans for future pollution-control measures. measures. W69-03667

THE HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF FLOW AND WATER-QUALITY CHARACTERISTICS,

For primary bibliographic entry see Field 02L. For abstract, see . W69-03668

TESTIMONY - PHILADELPHIA CONSERVA-TIONISTS, INC.,

TIONISTS, INC., Allston Jenkins. Estuarine Hearings, Subcommittee on Fisheries and Wildlife Conservation of the Committee on Merchant Marine and Fisheries, House of Representatives, 90th Congress, Serial No 90-3,

Descriptors: *Dredging, *Estuarine environment, *Industrial plants, *Industrial water, *Delaware River, Electric powerplants, Powerplants, Aquatic

Effects of Pollution—Group 5C

Environments. Conservation, environment. Buildings, Engineering structures, Structures, Docks, Nuclear powerplants, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters, Delaware River Basin Commission, Interstate commissions, River basin commissions. Water types.

Five case histories of estuarine despoliation in the Delaware River estuary are presented. Case histories discussed include: (1) construction for refineries, (2) dock and berthing facilities, (3) acquisition of land for a refinery tank farm and unloading facilities, and (4) acquisition of land for constructing a nuclear energy plant.

W69-03684

KEEPING OIL OUT OF THE SEA.

Ocean Industry, Vol 2, No 11, November, 1967, pp 10-16.

Descriptors: *Water pollution sources, *Oily water, *Oil wastes, *Ships, Oil industry, Industries, Organic matter, Wastes, Transportation, Oil.

The authors discuss various sources of oil pollution: tanker ballast and bilges, tanker disasters, sunken tankers, natural oil seeps. Also discussed are various means of combating oil spillage and ways of improving oil transporting. W69-03688

5C. Effects of Pollution

EUTROPHICATION,

isconsin Univ., Madison. Lab. of Limnology; and Wisconsin Univ., Madison. University-Industry Research Program.

Arthur D. Hasler, and Marlette E. Swenson. Science, Vol 158, No 3798, pp 278-282, 13 Oct

Descriptors: *Conferences, *Eutrophication, *Water pollution control, Water pollution sources, Water pollution effects, Water quality.

The first international symposium on eutrophication convened at The University of Wisconsin, Madison, during the period, 11-16 June 1967. Some 600 water research scientists, industrial representatives, state and federal governmental officials, and others interested in water pollution control heard addresses by 36 invited specialists and three governmental officials. Prior to the publication of detailed proceedings, scheduled to appear in early 1968, authors have published this short description of the activities of the symposium. Scope of the addresses includes case history studies of eutrophication; conditions in oligotrophic lakes; sedimentary history as relates to eutrophication; eutrophication in the Great Lakes region; identification of eutrophying processes; measurement of eutrophication rates; sources of plant nutrients; influences of micronutrients and growth factors; prevention; correction; sewage treatment; agricul-tural practices; zoning; positive characteristics of nural practices; zoning, positive characteristics of eutrophication; and systems analysis as a tool for study and prediction. Symposium was sponsored by National Academy of Sciences-National Research Council cooperating with US Atomic Energy Com-mission, US Department of the Interior. National Science Foundation, and Office of Naval Research. (Eichhorn-Wis)

DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND AQUATIC WEEDS, Wisconsin Univ., Madison. Water Chemistry Lab. George P. Fitzgerald.

J Phycol, Vol 4, No 2, pp 121-126, 1968. 6 p, 4 fig.

Descriptors: *Algae, *Analytical techniques, *Aquatic weeds, *Bioassay, *Essential nutrients, *Nitrogen compounds, Aquatic algae, Aquatic microbiology, Chlamydomonas, Chlorophyta,

Cyanophyta, Diatoms, Cycling nutrients, Environeyatiophyda, Diatoms, Cycling nutrients, Environ-mental effects, Ammonia, Ammonium compounds, Nitrogen fixation, Nutrient requirements, Nutrients, Physiological ecology, Phytoplankton, Rooted aquatic plants, Bioindicators.

The rate of ammonium-nitrogen absorption by algae and aquatic weeds in the dark has been shown to be 4 to 5 times greater for plants which are nitrogen-limited than for plants with sufficient available nitrogen. Eight species of green algae, 2 blue-green algae, 2 diatoms, and 3 aquatic weeds were used to demonstrate the usefulness of the test in determining it resiliable nitrogen. in determining if available nitrogen was in surplus or limited supply in a particular environment. The test was shown not to differentiate between bluegreen algae capable of fixing nitrogen (4 species) from media with nitrate-nitrogen or without combined nitrogen. The factors influencing the results of ammonium-nitrogen absorption tests have been investigated. In order to differentiate between plants with sufficient available nitrogen and those which are nitrogen-limited, the rate of ammoniumnitrogen absorption (0.1 mg nitrogen) over 1-hr incubation in the dark by 10-20 mg of algae or aquatic weed tissues is measured. The relatively simple analysis for ammonium-nitrogen in the samples makes it very easy to follow the changing nitrogen nutrition of plants in cultures with a limited nitrogen supply or in the presence of possible nitrogen sources. (Eichhorn-Wisc) W69-03364

STREAM NUTRIENTS, POLLUTION ALGAL.

Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

Werner Stumm, and James J. Morgan.

Sanitary Engineering Reprint No. 45. Trans 12th Ann Conf Sanitary Eng, Univ Kansas, pp 16-26, 1962. 11 p, 3 fig, 2 tab, 19 ref.

Descriptors: *Streams, *Water pollution effects, *Cycling nutrients, *Eutrophication, Algae, Aquatic algae, Aquatic bacteria, Aquatic microbiology, Balance of nature, Wisconsin, Bioassay, Biochemical oxygen demand, Environmental effects, Environmental sanitation, Essential nutrients, Harvesting of algae, Inhibition, Light penetration, Nitrogen compounds, Phosphorus compounds, Nutrient requirements, requirements, Photosynthetic oxygen, Water pollution control, Water pollution sources, Water pollution treat-ment, Pollution identification, Sewage, Sewage disposal, Sewage effluents, Sewage lagoons. Identifiers: Madison (Wis).

Since organisms are consumed as well as produced, size of standing biomass may bear little relation to organism activity rate. Aerobic biological sewage treatment mineralizes oxidizable organic sub stances but eliminates only 20-50% of nitrogen and phosphorus compounds. În sewage treatment, carpnosphorus compounds. In sewage treatment, car-bon becomes limiting before nitrogen and phosphorus are incorporated into sludge. Increase of phosphorus from detergents may reach point where phosphorus could no longer be considered a limiting factor. Sewage stabilization ponds represent mixture of bacterial decomposition and represent mixture of bacterial decomposition and algal growth, but, to remove nitrogen and phosphorus, algae must be separated from pond effuent. Decomposition of phytoplankton which settled to bottom of lake helps increase nutrient content of bottom waters during stagnation periods. Not all nutrients are regenerated. Madison, Wis, lakes retain 30-60% of nitrogen received. Contrasted with stabilization ponds, lake stagnation tends to separate autotrophs (algae) from heterotrophs (bacteria and animals). Relation between fertilization and algae is indicated by assumption that every ion of phosphorus added to water, if completely utilized for photosynthetic production, causes use of 16 nitrogen atoms and 106 atoms of carbon algal protoplasm. Complete oxidation of organic matter containing one atom of phosphorus requires 150 molecules of oxygen. Nutrient removal methods are reviewed. (Eichhorn-Wisc) W69-03369

STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON FOREST LAND,

Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg. For primary bibliographic entry see Field 05B. For abstract, see . W69-03381

RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST WATERS.

Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05B. For abstract, see . W69-03397

CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST ENVIRON-

Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05B. For abstract, see . W69-03399

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,

Pacific Northwest and Range Experiment Station, Corvallis, Oreg. Robert F. Tarrant. Reprint from Soc. Amer. Foresters Proc.

(1966):159-163.

Descriptors: *Pesticides, *Water pollution sources, *Forest management, *Water pollution control, Insecticides, Herbicides, DDT, 2-4 D, 2-4-5 T, Chemicals, Soil contamination, Watershed management. Identifiers: *Forest environment, Forest waters.

In relation to other areas of the chemical pollution problem, the forest environment is generally in good condition, but this fortunate situation can operate to our disadvantage if we remain com-placent. If forest watershed managers are to keep on top of the chemical pollution threat, we must:
(1) Use chemicals with proper regard for their
possible adverse effects on water quality; (2) Keep
alert to sources of chemical pollution in the forest
that are not under direct control of the forest manager; (3) Strengthen our programs leading to better public understanding of forest pollution and its problems; (4) Develop baseline values for forest water quality and monitor forest water systems to detect presence of chemical pollutants; and (5) Improve our research position to provide information leading to safe use of chemicals in the forest. (Author) W69-03401

MAGNOLIA PETROLEUM CO V STINSON (NEGLIGENT POLLUTION OF STREAMS).

93 So 2d 815-820 (Miss 1957).

Descriptors: *Mississippi, *Water pollution, *Pollutant identification, *Poisons, Judicial decisions, Intant identification, *Poisons, Judicial decisions, Riparian rights, Legal aspects, Water pollution sources, Analytical techniques, Oil wells, Salinity, Streams, Gullies, Overflow, Riparian land, Pastures, Sheep, Cattle, Ruminants. Identifiers: Negligence.

Plaintiff Stinson brought an action against an upstream oil well operator for injury to his sheep and cattle and damage to his pastures resulting from the negligent pollution of a stream which ran through Plaintiff's property. Defendant owned the property adjacent to appellee's land. An oil well on defendant's land was connected to the stream by a gully. Plaintiff discovered the pollution when he found a dead sheep and observed a mud formation in the stream. He traced the formation to defendant's well, adjacent to which there was a large pit used for mixing drilling muds. The mud and slime had overflowed into the gully and filtered into the

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C-Effects of Pollution

stream. Bags of drilling chemicals were on the ground around the pit and, due to recent heavy ground around the pit and, due to recent heavy rain, the bags were opened and their contents spread about. Expert testimony established that Plaintiff's animals died from poisoning, and an analysis of the water showed that the same chemicals used in drilling were present in the water. A jury found for Plaintiff, and the supreme court upheld this verdict, stating that a riparian owner has the right to have the water of the stream come nas the right to have the water of the stream come to him in its natural purity or its accustomed condition for his domestic use. The pollution here demonstrated constituted an actionable infringement on that right. (Sisserson-Fla) W69-03439

ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE. Federal Water Pollution Control Administration, Corvallis, Ore.; Pacific Northwest Water Lab, and Washington Univ., Seattle.

Proceedings of a Symposium Corvallis Ore., Sept 23-24, 1966. Oct, 1967, 111 p.

Descriptors: *Cyanophyta, *Eutrophication, *Plankton, Algae, *Nutrient Requirements. Identifiers: *Blue-green algae, *Alga blooms, *Eutrophication, Algae physiology.

The problem of accelerated eutrophication has many facets, and some are being examined through research to find the keys for solution. This symposi-um was held to fulfill the need to understand better the environmental requirements of blue-green algae. It contains eight papers by scientists who are concerned with the ecological control of algae blooms. Current knowledge on the subject has been evaluated and gaps identified for future investigation. The papers are followed by a general discussion and a specific discussion of nutrient measurement and nuisance control. (See also W69-03513 thru W69-03518) W69-03512

WHY STUDY BLUE-GREEN ALGAE. Washington Univ., Seattle. Dept. of Zoology.

W. T. Edmonson.

W. 1. Edmonson. Symposium on Environmental Requirements of Blue-green Algae. Federal Water Pollution Control Admin, Pacific Northwest Water Lab, Corvallis, Ore, pp 1-6, Oct 1967. 6 p, 11 ref.

Descriptors: *Cyanophyta, *Eutrophication, *Physiological ecology, *Water pollution effects, Algae, Algal control, Harvesting, Aquatic algae, Aquatic animals, Aquatic microbiology, Aquatic productivity, Balance of nature, Cycling nutrients, Environmental effects, Environmental sanitation, Essential nutrients, Inhibition, Light intensity, Limnology, Nitrogen compounds, Nuisance algae, Nutrient requirements, Phosphorus compounds, Photosynthetic oxygen, Phytoplankton, Plankton, Pollutant identification, Sewage effluents, Sewage disposal, Water pollution control, Water pollution

Identifiers: Lake Washington.

In 1950, L Washington had only 1,500,000 cubic microns per milliliter of phytoplankton, 15% of which were blue-green algae. In 1962, it had 10,500,000 cubic microns per milliliter of which 95% were blue-green algae, and the appearance of the lake stimulated the construction of an expensional management of the lake stimulated the construction of an expension and the stimulated the construction of an expension and the stimulated the construction of an expension and the stimulated the construction of the stimulated the stimulate sive sewage diversion program. The blue-greens attract attention because of the public nuisance they cause due to their ability to float and to concencause due to their ability to float and to concentrate downwind; they have special nutritional properties, are conspicuous in extreme kinds of habitats, and are important in forming and stabilizing soil. The colonial species of blue-greens are less readily eaten by some zooplankton, which may be a factor in their survival. The relationship between high nutrient waters and presence of blue-green algae is discussed, and it is pointed out that the blue-green, Oscillatoria agardhii, remained in L Washington, when nitrogen and phosphorus levels

were very low. The key to dominance of algal spewere very low. The key to dominance or algal species may be in the proportion of nutrients more than in quantity. More information is needed concerning antibiotic substances produced by algae. (For main entry see W69-03512)

PROBLEMS IN THE LABORATORY CULTURE OF PLANKTONIC BLUE-GREEN ALGAE, Manchester College, North Manchester, Ind.

Walliam R. Eberly.

Symposium on Environmental Requirements of Blue-Green Algae, Federal Water Pollution Control Admin, Pacific Northwest Water Lab, Corvallis, Ore, pp 7-34, Oct 1967. 28 p, 15 fig, 1 tab, 16

Descriptors: *Cyanophyta, *Physiological ecology, *Phytoplankton, *Cultures, Algae, Aquatic productivity, Cycling nutrients, Environmental effects, Essential nutrients, Eutrophication, Inhibition, Light intensity, Light penetration, Limnology, Nitrogen compounds, Nutrient requirements, Photosynthetic, Oxygen, Plankton, Water pollution

Identifiers: Algal taxonomy, Algae identification.

Surface blooms are usually dominated by either Chrococcales (microcystis) or filamentous forms (Anabaena or Aphanizomenon), whereas deep-water blooms are nearly always Oscillatoria. The author is concerned with the Oscillatoria associated with deep-water oxygen maxima (10-12 deg C, light 1% of surface intensity). Graphs are presented showing the rates of growth (OD) for a number of Oscillatoria isolates and the effects of initial inoculation level, pH, soil extract, tempera-ture, and light intensity in ASM and ASM-1 media. The taxonomic implications of these findings are discussed. Also considered is the problem of how algae in nature maintain their position, whereas in algae in nature maintain their position, whereas in laboratory cultures considerable turbulence is required to keep them suspended. Other problems reviewed are the relation between bacteria and al-gae, the almost unialgal blooms occurring in nature, and the relations between light and temperature. Author points out that with an increase of nutrients (eutrophication) light and temperature optimal might be raised with the result that the maximum concentration of algae would move closer to the surface. Seasonal downward movements of a bloom of Oscillatoria during the summer depletion of nutrients is described. (For main entry see W69-03512)
W69-03514

ASPECTS OF THE NITROGEN NUTRITION OF SOME NATURALLY OCCURRING POPULATIONS OF BLUE-GREEN ALGAE, Alaska Univ., College. Inst. of Marine Science. Vera A. (Dugdale) Billaud. Symposium on Environmental Requirements of Blue-green Algae, Federal Water Pollution Control Admin, Pacific Northwest Water Lab, Corvallis, Ore. pp 35-53, Oct 1967. 19 p, 5 fig, 6 tab, 19 ref.

Descriptors: *Cyanophyta, *Nitrogen compounds, *Nutrient requirements, *Physiological ecology, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Aquatic weeds, Balance of nature, Bioassay, Chlorophyta, Diatoms, Cycling nutrients, Environmental effects, Essential nutrients, Eutrophication, Inhibition, Light intensity, Light penetration, Limnology, Nitrogen cycle, Nitrogen fixation, Nutrients, Photosynthetic oxygen, Phytoplankton, Plankton, Rooted aquatic plants, Alaska.

Identifiers: Smith Lake (Alaska).

lt is well established that nitrogen-fixing blue-green It is well established that nutrogen-inxing blue-green algae increase the nitrogen content of waters, and it is assumed that this nitrogen is available upon degradation, to other algal species. Experiments in Smith Lake, central Alaska, indicate that an Anabaena population develops within a few days after ice breakup. During the summer, a steady, lower level of Aphanizomenon growth occurs. The

initial nitrogen used by Anabaena is ammonium-nitrogen; then nitrogen fixation becomes important, at one point accounting for half the nitrogen assimilated. The first Anabaena filaments growing assimilated. The first Anabaena filaments growing on ammonium-nitrogen have no heterocysts; they appear at the time nitrogen fixation occurs. The population of Aphanizomenon is very stable and appears to be controlled by grazing by dense population of zooplankton. Nitrogen fixation in significant rates only occurs during the Anabaena bloom. In another lake, Aphanizomenon occurs in anoxic, deeper waters. The presence of combined nitrogen sources does not appear to prevent nitrogen-fixing blooms from developing. (For main entry see W69-03512) W69-03515

ENVIRONMENTAL REQUIREMENTS THERMOPHILIC BLUE-GREEN ALGAE,

OF

Oregon Univ., Eugene, Dept. of Biology. Richard W. Castenholz.

Symposium Environmental Requirements of Blue-Symposium Environmental Requirements of Blue-Green Algae, Federal Water Pollution Control Ad-min, Pacific Northwest Water Lab, Corvallis, Ore. pp 55-79, Oct 1967. 25 p, 4 fig, 1 tab, 53 ref.

Descriptors: *Cyanophyta, *Physiological ecology, *Saline water, *Thermal water, Algae, Aquatic algae, Aquatic microbiology, Balance of nature, Bioassay, Chlorophyta, Diatoms, Environmental effects, Inhibition, Light, Light intensity, Light penetration, Limnology, Photosynthetic oxygen, Temperature, Thermal pollution, Thermal springs, Thermal stress.

Thermophilic algae are designated as those whose optimum temperature is above 45 deg C. The green mats formed in hot springs above 45 deg C may persist because of the absence of grazers. Thermophilic algae must be able to withstand the very high light intensities of the shallow spring waters. There light intensities of the shallow spring waters. There is a great similarity in the flora of hot springs throughout the world. Hot springs provide very constant temperature habitats, but some bluegreen thermophiles can withstand temperature shocks as great as room temperature to 70 deg C without effect. The highest temperature for consistent survival appears to be 74-75 deg C, but this limit may depend upon water chemistry. Details of observations on temperatures as related to habitats. observations on temperatures as related to habitats are presented and reviewed. The correlations of growth and light intensities found in field and laboratory studies are discussed. (For main entry see W69-03512) W69-03516

GROWTH REQUIREMENTS OF BLUE-GREEN ALGAE AS DEDUCED FROM THEIR NATU-RAL DISTRIBUTION,

Humboldt State Coll., Arcata, Calif. William C. Vinyard.

Symposium on Environmental Requirements of Blue-Green Algae, Federal Water Pollution Control Admin, Pacific Water Lab, Corvallis, Ore, pp 81-85, Oct 1968. 5 p, 2 ref.

Descriptors: *Eutrophication, *Cyanophyta, *Physiological ecology, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Balance of nature, Cycling nutrients, Environmental effects, Essential nutrients, Chlorophyta, Diatoms, Inhibition, Light, Light intensity, Light penetration, Limnology, Nutrient requirements, Nutrients, Photosynthetic oxygen, Phytoplankton, Saline water, Ecological distribution, California.

Organic pollution almost always insures an overabundance of blue-green algae. Also, excessive growth of cyanophytes occurs during periods when high temperatures and light intensities prevail. Because not all species of cyanophytes have nuisance significance, their taxonomy assumes some importance. Author indicates that knowledge relating to taxonomy is deficient and that modern studies relating systematics to physiological and other cultural requirements are needed. Information pertaining to the geographical distribution of

these algae is also required. Species of blue-greens predominate in sump ponds of non-brine oil fields containing crude oils and tars, some occurring at the bottom under the heavy scum of black tar, conditions which present the algae with little or no light and minimal possibility of gaseous diffusion into or out of the medium. In Freshwater Lagoon, a relatively cool coastal environment near Orick, Calif, a nearly continuous bloom, including Microcystis, Coelosphaerium and Anabaena, occurred for some five years. (For main entry see W69-03512) W69-03517

RECENT ADVANCES IN THE PHYSIOLOGY OF BLUE-GREEN ALGAE,

Scripps Institution of Oceanography, La Jolla,

Osmund Holm-Hanson.

Symposium on Environmental Requirements of Blue-Green Algae, Federal Water Pollution Control Admin, Northwest Water Lab, Corvallis, Ore, pp 87-96, Oct 1967. 10 p.

Descriptors: *Aquatic microbiology, *Physiological ecology, *Cyanophyta, Algae, Analytical techniques, Aquatic algae, Bioassay, Cycling nutrients, Environmental effects, Essential nutrients, Eutrophication, Freeze drying, Freezethaw tests, Freezing, Light intensity, Light penetra-tion, Limnology, Nitrogen compounds, Nitrogen fixation, Nutrients, Nutrient requirements, Photosynthetic oxygen, Phytoplankton, Chlorophyta.

Some of the subjects discussed are the morphology of blue-green algae compared to related algae or bacteria, the undefined manner in which bluegreen algae move, and their microelement nutrition. Presented are details of work on the resistance of blue-green algae to freezing and freeze-drying, especially algae isolated in Anarctica. Additions of horse serum, glycerol, milk powder, etc, may help the survival of green algae; but they do not help blue-greens. The question is raised as to what form of carbon the blue-greens can utilize; at pH 11 most carbon is present as carbonate ions. Results of experiments on the organic nutrition of Nostoc are presented which indicate that this alga can utilize glucose in the light but little or none in the dark. (For main entry see W69-03512) W69-03518

INDUSTRIAL WASTE GUIDE ON THERMAL POLLUTION,

Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab. For primary bibliographic entry see Field 05B. For abstract, see . W69-03537

THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,

Cold Regions Research and Engineering Lab., Hanover, N. H.

National Resources Res, Vol 4, No 2, pp 349-362, Apr 1968. 14 p, 7 fig, 1 tab, 21 ref.

Descriptors: *Thermal pollution, *Thermal power-plants, *Nuclear powerplants, *Rivers, *Ice, Navigation, St. Lawrence Seaway, Heat budget. Identifiers: Thermal pollution site.

An attempt is made to calculate the length of the An attempt is made to calculate the legislation in the circ-free reach that develops during the winter below a thermal pollution site on a river. A differential equation for the steady-state heat balance of a volume element of a river is developed. Heat losses due to evaporation, convection, long- and short-wave radiation, and other processes, are evaluated by an empirical or theoretical expression. The two principal limitations in accurately calculations of the control of the con lating downstream temperature changes are related to difficulties in evaluating the degree of lateral mixing in natural rivers and the convective and evaporative heat losses under unstable atmospheric conditions. Observations of lengths of ice-free reaches on the Mississippi River are in good agreement with the calculated values. Significant portions of the St. Lawrence Seaway can be kept icefree by the installation of nuclear reactors at appropriate locations. W69-03546

COMPUTATION OF REAERATION COEFFI-CIENTS FOR A RIVER SYSTEM IN NORTHEASTERN NEW JERSEY,

Geological Survey, Trenton, N. J.

Thomas J. Buchanan. Geol Surv Res 1968, Prof Pap 600-D, pp D42-D44, 1968. 3 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Reaeration, *Rivers, *New Jersey, Duration curves, Streamflow, Velocity, Depth.
Identifiers: Reaeration coefficients, Passaic River (New Jersey), Empirical methods.

Based on an empirical relationship, reaeration coefficients are computed for 16.8 mi of a river system in northeastern New Jersey for 3 different duration points- 50%, 80%, and 90%. The procedures used in obtaining the data and the results of the computations are shown. Discharges for the subreaches ranged from 16 cfs to 740 cfs, and the reaeration coefficients ranged from .0031 per day to 9.78 per day. The method used has accuracy limitations, but as long as this limitation is recognized by the users, the method and procedures outlined are an inexpensive and rapid way to determine reaeration coefficients for a stream system. (USGS)
W69-03561

BIOTIC RESPONSE TO POLLUTION REDUC-TION IN A RIVER, Michigan State Univ., Hickory Corners. W. K. Kel-

logg Biological Station.

Allen W. Knight, and George H. Lauff.

Project Termination Report, July 1967, Washington, D. C., 56 p, 16 tab, 10 fig, 14 ref. OWRR Project A-010-Mich.

Descriptors: *Stream pollution, *Pollution abatement, River, Effects of pollution.

A study of the Kalamazoo River was conducted to ascertain the conditions existing just prior to the intitation of a pollution abatement program. The river was found to be grossly polluted in a 20 mile stretch below the City of Kalamazoo. The decom-position of organic matter in the water and in exposition of organic matter in the water and in ex-tensive silt accumulations frequently depleted the dissolved oxygen for 20 miles or more below Kalamazoo. Sewage fungus covered the surface of the sludge deposits and stationary objects in the water while extensive numbers of sludge worms frequently occurred as an enormous red fringe along the river margins. Only a few of the more tolerant macroinvertebrates and fish occurred in the very polluted zone. In the lower reaches of the river considerable seff-purification was accomplished and a return of many of the macroinvertebrates and game fish was noted. The river prior to its discharge into Lake Michigan has accomplished considerable self-purification but carried a large load of suspended and dissolved materials into Lake Michigan.

W69-03602 river considerable self-purification was accom-

'PREDICTING DIURNAL VARIATIONS IN DIS-

SOLVED OXYGEN CAUSED BY ALGAE IN ESTUARINE WATERS, PART I', Stanford Univ., Stanford, California. Richard C. Bain, Jr. PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 250-279.

Descriptors: *Phytoplankton, *Dissolved oxygen, *Algae, *Diurnal distribution, *California, Estimating equations, Oxygenation, Standing crop,

Microenvironment, Aquatic life, Environment, Microorganisms, Water chemistry, Plants, Microorganisms, Water chemistry, Plants, Southwest U. S., Regions, Pacific coast regions, Geographical regions, Photosynthesis, Chemical reactions, Zooplankton, Animals, Aquatic animals, Photosynthetic oxygen, Gases, Oxygen, Oxygen demands, Eutrophication.

Eutrophic environments are often dominated by planktonic algal populations (phytoplankton) which can cause diurnal variations in dissolved oxygen concentrations through respiratory activity and photosynthesis. Photosynthetic oxygenation and respiratory deoxygenation rates of estuarine phytoplankton were measured at various standing crop (chlorophyll) levels. Oxygen production and consumption rates for actively growing phytoplankton populations were related to standing crop at 20 C and nonlimiting light. Variations in algal photosynthetic production rate as related to light adaption, age of cells, nutrition, temperature, and algal type are discussed. Light-production relationships (based on oceanographic literature) were used to estimate total production of a well-mixed system. Streeter-Phelps equations were modified to include phytoplankton production and respiration rates in formulations designed to predict dissolved oxygen concentrations over a 24 hour period. An example is given, and the resulting dissolved oxygen prediction is compared with field measurements from a tidal reach of the San Joaquin River, California W69-03611

'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',

Stanford Univ., Calif.

T. John Conomos, and M. Grant Gross In PROCEEDINGS OF THE NATIONAL SYM-POSIUM ON ESTUARINE POLLUTION, August 23-24, 1967, pp 486-516.

Descriptors: *Water circulation, *Columbia River basin, *Nutrients, *Eutrophication, Circulation, Regions, River basins.

This paper reviews recent work on the Columbia River estuary and the nearby Northeast Pacific Ocean. Particular attention is focused on circulation and mixing near the river mouth and on those factors controlling the supply, distribution, and utilization of plant nutrients (nitrate, inorganic phosphate, and reactive silicate) in this area during the summers of 1965 and 1966. The processes discussed here will also affect other substances discharged into the coastal ocean, making it possible, in some cases, to predict their behavior by analogy with the known behavior of these naturally occurring materials.

W69-03632

CONSEQUENCES OF MAJOR SPILLS ON IN-DUSTRIAL USES OF SEAWATER. National Security Industrial Association, Washing-

ton, D. C.

In MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CON-SEQUENCES, Ocean Resources Subcommittee Meeting, December 11, 1967.

Descriptors: *Industrial water, *Water pollution sources, *Ships, *Water pollution effects, Saline water, Navigation, Environmental effects, Water types, Transportation, Oil industry, Mineral industry, Industries, Non-consumptive use, Efficiencies, Water utilization, Transportation.

The article classifies water shipments into three groups: (1) petroleum and by-products, (2) natural ores, and (3) foods. Spillage of each type of cargo has a different effect on seawater; each effect is W69-03633

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C-Effects of Pollution

CONDITION OF THE QUAHOG, MER-CENARIA MERCENARIA, FROM POLLUTED AND UNPOLLUTED WATERS,

R. A. Copper, S. B. Chenoweth, and N. Marshall. Chesapeake Science, Vol 5, No 4, Winter, 1964, pp

Descriptors: *Clams, *Water pollution effects, *Environmental effects, Pollutants, Water pollution, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Commercial shellfish, Invertebrates, Mollusks, Shellfish, Water quality, Estuarine environment, Aquatic environment, En-

The authors suggest that if environmental conditions which have been altered by pollution are beneficial to quahog clams, it is not evident from comparisons of the quality of meats from clams from polluted areas as opposed to clams from unpolluted areas.
W69-03635

PRELIMINARY ASSESSMENT OF THE EN-GLISH SOLE IN PORT GARDNER, WASHING-TON.

T. Saunders English.

Water Pollution Control Federation, Journal, Vol 39, No 8, August, 1967, pp 1337-1350.

Descriptors: *Pulp wastes, *Commercial fish, *Water pollution effects, *Washington, Water pollution sources, Trawling, Industrial wastes, Wastes. Animals, Aquatic animals, Aquatic life, Fish, Wildiffe, Geographical regions, Pacific coast region, Pacific northwest U. S., Regions, Fishing, Competing uses, Efficiencies, Water utilization.

The biological effects of pollution in Puget Sound have been the subject of considerable dispute for many years, and more recently the subject of considerable research effort. This article presents preliminary results of research on the effects of a major sulfite paper mill submarine outfall on a single important species of finfish, the English sole. The author concludes that the multiple use of Port Gardner for receiving pulp and paper mill effluents and commercial trawling for English sole does not appear to be harmful to the fishery. The shallow area near the deep-diffuser outfall appears to be a source of young English sole recruited to an increasingly productive commercial stock. Unless some unexpected discontinuity becomes apparent. the complete life cycle of the English sole seems to be represented in Port Gardner. W69-03660

BIOLOGICAL EFFECTS OF SPOIL DISPOSAL

IN CHESAPEAKE BAY,
David A. Flemer, W. L. Dovel, H. T. Pfitzenmeyer,
and D. E. Ritchie, Jr.

Journal of the Sanitary Engineering Division, Vol 94, No SA4, August, 1968, pp 683-706.

Descriptors: *Eutrophication, *Sedimentation, *Water quality, *Water pollution, *Waste disposal, Environment, Aquatic environment, Geographical regions, Coastal plains, Atlantic coastal plain, Wildlife, Estuarine environment, Ecology, Growth stages, Fish, Plants, Streamflow, Water analysis, Water chemistry, Regions, Larvae, Phytoplankton, Flow, Channel flow, Zooplankton, Animals, Aquatic animals, Aquatic life, Plankton, Analysis, Sediment distribution, Sediment transport.

Field studies were made on the biota of the upper Chesapeake Bay under a design related to the shal-low water disposal of channel sediments. No gross effects were observed on the phyto-zooplankton fish, eggs, and fish larvae of adult fishes. Some bottom animals were smothered over a wide area. Several benthic species survived deposition and certain species began repopulation soon after deposition. W69-03666

SAVE-THE-SALMON PROJECT ON THE ST. IOHN RIVER.

G. J. Gillespie.
Fisheries of Canada, Vol 20, No 4, October, 1967, nn 9-11

Descriptors: *Salmon, *Hydroelectric plants, *Multiple-purpose projects, *Fish conservation, Sport fish, Fish hatcheries, Fish management, Fish Sport 18th, Fish natcheries, Fish nanagement, Fish migration, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Afterbays, Animals, Aquatic animals, Aquatic life, Fish, Salmonids, Wildlife, Conservation, Wildlife conservation, Projects, Management.

The author describes a joint project between Canada's Department of Fisheries and the New Brunswick Electric Power Commission to conserve fish which would otherwise be destroyed by a power plant. The author feels that the results of this project should have widespread consequences in ard to fish conservation practices. regard to na. W69-03669

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,

John W. Gore.

Committee on Public Works, U. S. Senate, Washington, D. C., April 17, 1968.

Descriptors: *Virginia, *Maryland, *Thermal powerplants, *Heated water, *Environmental effects, Southeast U. S., Bays, Appalachian Mountain rects, Southeast U. S., Bays, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Fisheries, Commercial fisheries, Benefits, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Temperature, Water types.

The thermal effects of a large electric-generating plant on Chesapeake Bay are discussed. The con-clusion is that the effluent from the plant would be more pure than natural bay water, and the discharge of warm water would not be detrimental to the ecology of the Bay. Instead, winter fisheries could be created. W69-03670

'STATEMENT', Federal Water Pollution Control Administration,

Adlanta, Ga.
John M. Henderson.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968. 9 p.

Descriptors: *Water pollution effects, bescriptors: "Water pointion effects, "Enteric bacteria, "Diseases, "Recreation, "Shellfish, "Commercial fishing, Water quality, Sewage bacteria, Sewage effluents, Bacteria, Microorganisms, Plants, Effluents, Aquatic animals, Aquatic life, Animals, Fishing, Industries.

This paper is concerned with filth-borne (enteric) disease occurrence and related procedures and standards for determining the safety of estuarine waters for recreational use or shellfish growing. The term 'filth-borne (enteric)' disease is intended to include all diseases contracted as a result of sewage pollution or other fecal pollution and not merely those diseases which are confined to the gastro-intestinal tract of man. These two subjects, recreational water use and shellfish production and consumption, have points in common and also distinct differences between them as they relate to human disease. W69-03678

INTERIM REPORT ON GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL.

Chesapeake Biological Laboratory, Natural Resources Institute, University of Maryland, Ref No 67-34, May, 1967.

Descriptors: *Sediments, *Dredging, *Water pollution effects, *Aquatic plants, *Aquatic animals, Sediment control, Growth stages, Fish eggs, Channel improvement, Hydrography, Geology, Phytoplankton, Zooplankton, Larvae, Eggs, Bays, Bodies of water, Maryland, Appalachian Mountain region, Sediment discharge, Control, Atlantic coastal plain, Coastal plains, Geographical region, Northeast U. S., Regions, Hydrologic aspects, Aquatic life, Plankton, Plants, Animals, Benthos.

This interim report describes the effects associated This interim report describes the effects associated with 1966 channel dredging in Chesapeake Bay. The effects considered were on geology and hydrography, phytoplankton, benthos, zooplankton, fish eggs and larvae, and adult fish. Observed effects of the disposal were summarized by the authors as: (1) Fine sediments from the channel were released in shoal water, over similar sediments, as a semi-liquid mixture, (2) Sediments were spread over an area at least five times as large as the designated disposal area, (3) There was highly localized release of nutrient chemicals, highly localized release of nutrient chemicals, roughly equivalent to a sewer outfall from a town of about 10,000 people, (4) No gross effect was observed on the microscopic plants and animals in the water, nor on the eggs and larvae of fish, nor on adult fish held in cages near the outfall or caught near the area, (5) Some bottom animals were smothered over a wide area, so that a significant loss occurred. Some species survived deposition, and certain species began repopulation soon after deposition. W69-03682

'U. S. COAST GUARD REPORT OF WAKE ISLAND OIL SPILL'

National Security Industrial Association, Washington, D. C

william A. Jenkins.
In MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES, Ocean Resources Subcommittee Meeting, December 12, 1967.

Descriptors: *Oil wastes, *Disasters, *Foreign countries, *Water pollution, Beaches, Air pollution, Environmental effects, Geographical regions, Regions, Organic matter, Wastes.

The Wake Island oil spill is described in great detail. All the repercussions of this disaster are discussed: (1) air pollution, (2) shoreline pollution, and (3) small boat harbor pollution. The problem was alleviated by the passage of a typhoon which scoured away much of the polluted area.

'ENVIRONMENTAL REACTION TO WATER POLLUTION'

National Security Industrial Association, Washington, D. C.

ton, D.C.
Kenneth E. Biglane.
MARINE, ESTUARIAN, AND RIPARIAN POL-LUTION DISASTERS AND THEIR CON-SEQUENCES, Ocean Resources Subcommittee Meeting, December 12, 1967.

Descriptors: *Water pollution effects, *Environmental effects, *Water pollution, *Disasters, Social

The author states that an accidental or sudden release of pollutants to the aquatic environment usually causes a more spectacular reaction by the inhabitants or users of the resource than does the continuous discharge which slowly erodes the quality of the resource. The recovery of the resource from both sudden release and continuous waste discharges is dependent upon the type and quantity of material released. Usually, one thinks of the environment recovering much faster from the effects of a sudden and non-recurring waste discharge. Several types of sudden release of shock-type discharges and their primary and secondary effects on the aquatic environment are discussed. The author states that an accidental or sudden W69-03693

'NUTRIENT ASSIMILATION IN A VIRGINIA

TIDAL SYSTEM',
Stanford Univ., Calif.
Morris L. Brehmer.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 2325, 1967, pp 218-237.

Descriptors: *Water properties, *Nutrients, *Virginia, Nitrogen compounds, Phosphorus, Nuisance algae, Salts, Tides, Southeast U. S., Regions, Geographical regions, Coastal plains, Atlantic coastal plain, Inorganic compounds, Metals, Plankton, Aquatic life, Zooplankton, Aquatic animals, Animals, Appalachian Mountain region.

This study was conducted to assess nutrient assimilation and phytoplankton response in the tidal James River Estuary and in the Nansemond Estua-ry, a tributary to the James. The assimilation of nitrogen and phosphorus was measured for a period of one year in each of the above two river systems. It was determined that the nutrient assystems. It was determined that the nutrent as-similation capacity of estuarine waters varies seasonally, being greatest in the winter, even though fresh water discharge levels may remain nearly constant. Date indicate that water containing dissolved solids of marine origin may be able to assimilate higher nutrient levels than fresh water without producing aquatic nuisance conditions. W69-03695

5D. Waste Treatment **Processes**

THE LAKE TAHOE WATER RECLAMATION

PLANT, Russell L. Culp., and Ralph E. Roderick. Water Pollution Control Federation, Journal, Vol 38, No 2, February, 1966, pp 147-155.

Descriptors: *Tertiary treatment, *Desalination, *Water reuse, *Treatment facilities, *Cost com-parisons, Waste water treatment, Sewage treatment, Waste treatment, Demineralization, Separa-tion techniques, Water purification, Water treatment, Effluents.

The authors describe the new tertiary sewage treatment plant of South Tahoe Public Utility District which produces a high quality, colorless, odorless effluent. The article presents construction and operating cost estimates for plants of 2.5, 10.0, 50.0, 100.0, and 200.0 mgd capacity, and for varying degrees of treatment. A principal conclusion is that the total cost of providing the maximum quality tertiary treatment with this process would vary from 24 cents to 37 cents/cap/month, depending on the size of the treatment plant. This estimated cost is based upon an average estimated effluent volume of 100 gpd per capita. The authors also conclude that 'tertiary treatment provides an economic advantage over desalination as a source of water, since wastewater can be renovated for only 10-15 percent of the latest realistic estimates of cost for desalination'.

W69-03640 W69-03640

SOME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT,

Robert K. Davis.
Water Pollution Control Federation, Journal, Vol 37, No 12. December, 1965, pp 1617-1628.

Descriptors: *Waste water treatment, *Capital costs, *Operating costs, *Water quality control, *Flow augmentation, Costs, Alternative costs, Economic efficiency, Methodology, Quality control, Control, Waste treatment, Regulation, Water treatment, Maryland, Virginia, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S., Flow control.

Research aimed at achieving least cost systems of obtaining a given water quality control objective in the Potomac Estuary is discussed. Basic economic

concepts involved in determining trade offs between flow augmentation and waste treatment are presented. One principal conclusion is that higher levels of waste treatment, together with low nigner levels of waste treatment, together with tow-flow augmentation, appear to have a place in the solution of water quality management problems of the sort represented by this illustrative case. The study's view of the waste treatment process is unconventional in nature, in that it finds discontinuous operation of certain processes in the plant and possibly more than one level of intensity of operation as desirable. The reasons for this are substantial differences in capital costs and operating costs among the various processes. The first concerns the advantages of substituting operating costs for capital costs, such as might be done in a choice between chemical precipitation and additional aeration capacity for the advanced treatment. For aeration capacity for the advanced treatment. For sanitary engineers, the study states the conclusion of interest is that in the design of treatment processes to respond to variations in pollution con-ditions there needs to be great weight attached to the advantages of processes which incur relatively high operating costs and relatively low capital costs. Cost data are presented to support these conclusions. W69-03644

SEATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES,

For primary bibliographic entry see Field 05G. For abstract, see . W69-03683

REGIONAL CONSTRUCTION REQUIRE-MENTS FOR WATER AND WASTEWATER FACILITIES 1955-1967-1980,

K. L. Kollar, and August F. Volonte. Report, Business and Defense Services Administra-tion, Water Industries and Engineering Services Division, October, 1967.

Descriptors: *Waste water treatment, *Investment, *Forecasting, *Construction costs, Waste treatment, Water treatment, Costs, Treatment facilities.

This Department of Commerce study provides historical construction-cost data from 1955 to 1966 and a projection of requirements from 1967 to 1980. Population projections and wastewater investment requirements by major census regions are given. A breakdown by investment requirements for collection systems, treatment plants, and treatment plant equipment is included. W69-03698

PROBABILISTIC ANALYSIS OF WASTE WATER TREATMENT AND DISPOSAL SYSTEM.

Veerasamy Kothandarman. Illinois Univ, Urbana, Research Report No 14, June, 1968.

Descriptors: *Oxygen sag, *Recreation, *Oxygenation, *Statistical models, Mathematical models, Probability, Biochemical oxygen demand, Oxygen demand, Aeration, Mathematical studies, Model studies, Waste water treatment, Waste treatment, Water treatment.

This work attempts to predict dissolved oxygen deficits in a stream with known initial conditions by deficits in a stream with known initial conditions by taking into account the variations in deoxygenation and reaeration coefficients. A hypothetical stream situation is used to establish the significance in predicting dissolved oxygen deficit. Statistical models are formulated and tested for the variations in these coefficients using published data. Simulation techniques using the Monte Carlo method are employed in predicting the probabilistic variation in dissolved oxygen deficits for known initial conditions, and the results are verified with the survey data observed for the Ohio River-Cincinnati Pool reach. The predicted results using probabilistic model are found to agree with the observed values within practical limits and give more consistent results than conventional methods. W69-03699

5E. Ultimate Disposal of Wastes

FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN ILLINOIS,

Illinois State Geological Survey, Urbana

Robert E. Bergstrom. Ground Water, J Tech Div Nat Water Well Ass, Vol 6, No 5, pp 5-9, Sept-Oct 1968. 5 p, 3 fig, 1 ref.

Descriptors: *Injection wells, *Waste disposal, *Illinois, Aquifers, Aquicludes, Well regulations, Water resources, Groundwater.

Identifiers: *Subsurface waste disposal, Feasibility investigations.

The criteria for feasibility of waste disposal by injection wells in Illinois and the suitability of various geologic formations for disposal are reviewed. Favorable geohydrologic conditions—specifically the presence of a variety of permeable formations that contain nonpotable water and are well confined from shallow to great depth - make waste disposal by wells feasible in much of the southern two-thirds of Illinois. Natural safeguards permit disposal wells to be planned with conventional engineering precautions and only a minimal program of preoperational testing. In much of the northern third of the State, the permeable rocks contain potable water to great depth, and there is moderate to high development of the groundwater resource because of urban and industrial concentration. Exhaustive testing, substantial proof of acceptable site conditions, and incorporation of optimum engineering safeguards are considered necessary before the State regulatory agency can authorize installation. (Knapp-USGS)
W69-03251

ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING,

Oak Ridge National Lab., Oak Ridge, Tenn. Health Physics Div.

For primary bibliographic entry see Field 08E. For abstract, see. W69-03522

5F. Water Treatment and **Quality Alteration**

STRIPPING EFFLUENTS OF NUTRIENTS BY BIOLOGICAL MEANS, Wisconsin Univ., Madison. Sanitary Lab.

George P. Fitzgerald.
Trans of the Seminar on Algae and Metropolitan
Wastes, Robert A Taft San Engr Ctr, Cincinnati,
1961. pp 136-139, 5 fig.

Descriptors: *Nutrient requirements, *Eutrophica-Descriptors: *Nutrient requirements, *Eutrophication, *Water pollution control, *Water pollution treatment, Algae, Algal control, Analytical techniques, Aquatic algae, Aquatic microbiology, Balance of nature, Bioassay, Biochemical oxygen demand, Chlorophyta, Cycling nutrients, Environmental effects, Essential nutrients, Environmental engineering, Harvesting algae, Nitrogen compounds, Phosphorus compounds, Photosynthetic oxygen, Physiological ecology, Phytoplankton, Sewage, Sewage bacteria, Sewage disposal, Sewage effluents, Sewage lagoons, Sewage treatment, Water pollution, Water pollution sources.

Laboratory experiments with the green alga Chlorella pyrenoidosa (Wis 2005) have shown this alga would first absorb the ammonium-nitrogen, then nitrite-nitrogen and nitrate-nitrogen from secondary sewage effluents. Less than 0.5 mg/liter of any of the nitrogen or phosphorus of the effluent remained in solution after 17 days of culture. Growth of Chlorella paralleled nitrogen and phosphorus removal in primary and secondary effluent. Growth in secondary effluent could be stimulated by the addition of carbon dioxide to air.

Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F-Water Treatment and Quality Alteration

The operation of a 1/2-acre stabilization pond for The operation of a 1/2-acre stabilization point for nutrient removal by algae in the pond indicated that a succession of algal species took place despite a continuous supply of nutrients. The average nitrogen removal throughout the year is about 30%, with summer removals reaching about 70%. There were only 33 days during 1956 and 76 days during 1957 when nitrogen removal exceeded 50%. Phosphorus removal coincided with periods of high pH. During early winter, pond effluent contained higher levels of phosphorus than influent due to dissolution of precipitated phosphorus. (Eichhorn-W69-03374

5G. Water Quality Control

THE EFFECT OF TURBULENCE ON BACTERI-AL SUBSTRATE UTILIZATION, Georgia Inst. of Tech., Atlanta. School of Engineering; and Georgia Inst. of Tech., Atlanta. Water Resources Center.

John T. Marlar. Georgia Inst Tech Water Resource Center Rep No. WRC-0568, Dec 1968. 110 p, 23 fig, 3 tab, 66 ref, 3 append.

Descriptors: *Bacteria, *Oxygen demand, *Turbulence, Reaeration, Kinetics, Growth rates. Identifiers: Bacterial growth kinetics.

A laboratory study was made of the interaction of a heterogeneous population of bacteria with a glu-cose substrate. The effect of turbulence on substrate utilization was shown by a series of tests with different turbulence levels, in which deoxygenation and reaeration were monitored continuously. Initial bacterial concentration is an important growth rate variable and methods were developed to prerate variable and methods were developed to predict its effect. Oxygen utilization was directly proportional to substrate utilization and did not follow first order kinetics; the equation developed for bacterial growth kinetics was based on Monod's equation. Bacterial growth rate and the rate of substrate removal increased with turbulence. (Knapp-USGS) W69-03343

POLLUTION CONTROL - PLANNING A NA-

TIONAL PROGRAM,
Federal Water Pollution Control Administration, Washington, D. C. Allan Hirsch.

For eight vol Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 140-151, (1968.) 12 p, 6 ref.

Descriptors: *Water pollution control, *Water policy, *Water quality, *Future planning (Projected), Regulation, Water law, Pollution abatement, Water pollution treatment, Water pollution effects, Sewage treatment, Wastes treatment, Waste disposal, Legislation, Data collection, Water allocation (Policy), Long-term planning. Identifiers: Water pllution policy, Regional pollution control.

To meet the present and future demands for more effective pollution control, planning on a national scale must precede any proposals. Therefore, general policies and approaches rather than techniques of program planning are discussed. Federal planning in pollution control has not diminished and should not diminish the state and local role; rather, it should be increased through federal incentive and leadership. There are 5 areas of planning in which progress is needed: (1) constructing and operating waste treatment works; (2) developing and applying new and improved technology through research and development; (3) providing an adequate supply of trained manpower; (4) collecting and evaluating pollution control data; (5) developing regional pollution control dystems on a coordinated basis. Long-range planning must be preceded by setting water quality standards with rigid associated compliance plans. The author concludes that the near future will bring, through planned programs, control of con-

ventional pollution and the ability to cope with new sources of pollution. (Helwig-Fla) W69-03410

FENWICK V BLUEBIRD COAL COMPANY (MINE WASTES).

12 Ill App 464, 140 NE 2d 129-133 (4th Dist Ct Ill

Descriptors: *Illinois, *Coal mine wastes, *Natural flow doctrine, *Mine drainage, Pollutants, Water pollution, Water pollution effects, Mine wastes, Mine water, impaired water quality, Drainage systems, Surface runoff, Surface waters, Watercourses (Legal aspects).
Identifiers: Mineral impurities, Coal washer.

In an action now on appeal by timberland owners against coal companies for damage to growing timber, plaintiffs alleged that the timber damage resulted from the mineral impurities the coal companies permitted to drain upon plaintiffs' lands from their coal mining operations. Defendants contended that there was no evidence upon which a determination regarding damages could legally rest. The Illinois Appellate Court held for the plain-tiffs after disposing of several procedural issues raised by defendants. The court stated that every owner of land through which water flows, either as surface water or in a stream, has the right to have the same flow in its natural state, which extends to the quality as well as the quantity of the water. One who pollutes or contaminates the water is liable to those injured thereby. (Carruthers-Fla) W69-03425

POLLUTION CONTROL.

N Y Conserv Law sec 801 art 5 secs 5.1, 5.2, 5.3, 5.4 (McKinney 1967).

Descriptors: *Delaware River Basin Commission, Legislation, *Interstate compacts, Water policy, Pollution abatement, *Water pollution control, Pollutants, Administrative agencies, Legal aspects,

The Commission has authority to undertake investigations and to acquire and operate facilities to control present or potential pollution conditions in the basin. The standard of control is that pollution originating from a signatory state shall not injuriously affect waters of the basin. After a public hearing the Commission may classify the waters of the basin and establish standards for treatment of pol-lutants entering the waters of the basin. The signatories agree to cooperate and enact the necessary legislation to further the goals of the compact. The Commission may by order enjoin the discharge of pollutants into the waters of the basin. Such an order is subject to judicial review. (Molica-Fla) W69-03460

INDUSTRIAL WASTE GUIDE ON THERMAL

INDUSTRIAL WASTE GUIDE ON THERMAL POLLUTION, Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab. For primary bibliographic entry see Field 05B. For abstract, see W69-03537

COMPUTATION OF REAERATION COEFFI-CIENTS FOR A RIVER SYSTEM IN NORTHEASTERN NEW JERSEY,

Geological Survey, Trenton, N. J.
For primary bibliographic entry see Field 05C. For abstract, see. W69-03561

SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON A NATIONAL SCALE,
James H. McDermott.

For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 71-80, 1968. 10 p, 8 ref.

Descriptors: *Water pollution, *Monitoring, *Sampling, *Water quality control, Conferences, Publications, Standards, Administrative agencies, Water Quality Act, data collection, On-site inspections, Statistics, State governments, Legislation, Water pollution control, Waste treatment, Water utilization.

Identifiers: Potomac River, Clean Water Restoration Act.

Surveillance practiced by the Federal Water Pollution Control Administration involves information collection to determine the status of water pollution control. Two categories of statistics are collected: (1) water uses, waste treatment, control facilities and economic conditions; (2) the evaluation of water quality on a point basis. This provides a quantitative check on pollution control progress. In order to monitor in-stream conditions for immediate relation to the established water quality standards, the following activities are pursued: (1) a Water Quality Compliance System which consists of monitoring stations; (2) Oil Pollution Act Laboratory Services to detect and analyze petroleum compounds; (3) Specialized Analytical Services; (4) Analytical Quality Control; (5) Data Evaluation and Control. A map is included locating the monitoring stations in the major basins. General criteria for the operation of a surveillance system are presented. The Potomac Monitoring System is explained to illustrate the use of auto matic instrumentation. States can best conduct three levels of surveillance: (1) On-site inspection of municipal and industrial waste handling; (2) monitoring individual plant effluent lines; (3) examination of the receiving body to assure adopted water quality standards. (Childs-Fla)

'ESTUARINE **OXYGEN** RESOURCES-PHOTOSYNTHESIS AND REAERATION',

Stanford Univ., Stanford, California.

Thomas E. Bailey.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 2325, 1967, pp 310-330.

Descriptors: *Reaeration, *Photosynthesis, *Oxygenation, *Diffusion, *California, *Water quality, Pacific coast region, Dissolved oxygen, Chemical reactions, Chlorophyll, Magnesium compounds, Southwest U. S., Geographical regions, Regions, Water properties, Organic compounds, Pigments, Plant pigments, Solar radiation, Radiation, Temperature, Water temperature.

This paper presents a discussion of the primary Sources of oxygen supplied to the Sacramento-San Joaquin Estuary and Suisun Bay system through photosynthesis and reaeration. Results of field surveys are presented. Changes in oxygen levels due to photosynthesis can be predicted by an empirical equation as a function of chlorophyll concentration, solar intensity, light extinction coefficient, temperature, and water depth. It was concluded, however, that reaeration and diffusion rates are too complex to be predicted reliably by empirical relationships and that direct field measurements must be made to obtain reliable data. W69-03610

ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL.

Samuel S. Baxter.

Water Pollution Control Federation, Journal, Vol 37, No 10, October, 1965, pp 1363-1369.

Descriptors: *Cost-benefit ratio, *Water pollution control, *Economic justification, Beneficial use, Control, Water pollution treatment, Water treatment, Cost-benefit analysis.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

Water-pollution-control expenditures should be justified on the basis of a favorable benefit-cost ratio. The author considers the following four topics with respect to pollution-control expenditures:
(1) The purposes and uses expected of receiving streams. (2) The actual benefits and improvements derived from the stream if a higher degree of treatment is used. (3) The relation between the costs and benefits from different degrees of treatment. (4) The relation of the costs and benefits of pollution control to the costs and benefits of other civic programs. W69-03613

'STATEMENT', Federal Water Pollution Control Administration, Atlanta, Ga. W. D. Burbanck.

W.D. Burbanck.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 20, 1968, pp 25-30.

Descriptors: *Water quality control, *Model stu-Descriptors: "Water quality control, "Model studies, "Water pollution control, Food chains, Georgia, Water pollution treatment, Water treatment, Water pollution sources, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Control, Soil conservation, Water resources development, Resource development.

The problem of pollution should be faced with two objectives: (1) To clean up areas such as Delaware Bay where pollution has become extensive and (2) To practice conservation in areas that still approximate natural conditions. A multi-disciplinary model approach for the management of estuaries is desirable, since there are so many aspects of pollution and varied effects from it.

THE PROBLEM OF PESTICIDES IN ESTUA-

Philip A. Butler.

A Symposium on Estuarine Fisheries, American Fisheries Society, Special Publication No 3, 1966, pp 110-115.

Descriptors: *Pesticide toxicity, *Water pollution effects, *Estuarine environment, *Aquatic animals, *Environmental effects, Pesticides, Water pollution, Toxicity, Toxins, Mortality, Morbidity, Fishkill, Water pollution sources, Pesticide residues, Aquatic environment, Environment, Animals, Aquatic life, Pollutants, Regions, Seasonal, Economic impact, Marine animals.

Despite two decades of research, the extent and importance of pesticide pollution in estuaries are poorly understood. Laboratory studies of their acute and chronic toxicity indicate that pesticides may be the cause of ill-defined but significant mortality, loss of production, and, perhaps, changes in the direction of natural selection in estuarine fauna. Preliminary investigations show the need for a continuing surveillance program to identify the seasonal and geographical distribution of pesticide pollution in estuaries.

W69-03618

ECONOMICS OF WATER POLLUTION CON-

TROL, Emery N. Castle. Water Pollution Control Federation, Journal, Vol 38, No 5, May, 1966, pp 789-793.

Descriptors: *Economic efficiency, *Water pollution control, *Water quality control, Resource allocation, Water quality, Control, Quality control, Regulation, Administration.

This article is a brief, concise, and well-written exposition of the relationship of market economics to optimal water quality management, and of the possible techniques and institutions for resolving

the problem of external diseconomies which stern from water pollution. Arguments are presented for and against (1) detailed administrative regulation, (2) maintenance of minimum standards, and (3) basin-wide or regional organizations, as appropriate approaches to the external diseconomies problem. It is concluded that the latter approach is superior to the former two. W69-03623

FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,

American Littoral Society, Special Publication No

Descriptors: *Estuarine fisheries, *Estuarine environment, *Environmental effects, *Productivity, *Fish harvest, Commercial fishing, Commercial shellfish, Sport fishing, Conservation, Landfills, Mining, Control, Navigation, Water control, Fisheries, Aquatic environment, Environment, pollution, Aquatic animals, Animals, Aquatic life, Aquatic plants, Plants, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Fishing, Industries, Invertebrates, Shellfish, Value.

This report is a discussion of the estuarine environment specifically as it relates to salt water fish, and the effect that human progress has on that environment. The conflicts are discussed between the need for conservation of our estuarine resources and the need for progress, particularly in the areas of land fill, navigation, gravel and sand mining, mosquito control and marsh impoundment, highway construction, and water control. It is argued that even small amounts of damage to estuarine areas can lead to widespread damage to an estuarine resource. A discussion of the economic value of fisheries is provided. It is stated that at least \$75 million worth of estuarine dependent fish are landed each year along the Atlantic coast. A review of the activities of each of the Atlantic coastal states in relation to conservation of the estuaries is given. W69-03627

CLEAN WATER FOR THE NATION'S ESTUA-

Federal Water Pollution Control Administration, Atlanta, Ga.

PROCEEDINGS OF THE PUERTO RICO PUBLIC MEETING, NATIONAL ESTUARINE POLLUTION STUDY, SANTUREE, PUERTO RICO, April 22, 1968.

Descriptors: *Puerto Rico, *Waste water disposal, *Water pollution control, *Industrial wastes, *Sewage effluents, Water quality control, Geographical regions, Islands, Regions, Waste disposal.

The papers presented at this meeting are chiefly concerned with industrial and sewage pollution of the bays and inlet of densely populated Puerto Rico. A need for water pollution control within the limitations of the budget and the necessity for industrial expansion is discussed. W69-03629

MARINE SHIPPING INDUSTRY - EFFECTS AND IMPACTS ON THE CHESAPEAKE BAY, James B. Coulter.

Governor's Conference on Chesapeake Bay, Wye Institute, Queen Anne's County, Maryland, September 12-13, 1968.

Descriptors: *Legislation, *Water pollution, *Channel improvement, *Commercial fishing, *Maryland, Bodies of water, Water sports, Recreation, Navigation, Dredging, Desilting, Sewage effluents, Separation techniques, Fishing, Bays, Oily water, Waste disposal, Sewage disposal, Effluents, Industries, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Navigable waters.

Actions to be taken by State and Federal Governments regarding water pollution and shipping channel and harbor improvements in the Chesapeake Bay area are outlined. Legislation is required to free the harbor of pollutants such as floating litter. sewage, and industrial wastes. W69-03636

THE CONDITION OF THE CHESAPEAKE BAY. For primary bibliographic entry see Field 06B. For abstract, see . W69-03637

'PLANNING A WATER QUALITY MANAGE-MENT SYSTEM: THE CASE OF THE POTOMAC ESTUARY', Robert K. Davis

In WATER RESEARCH, pp 99-121. Johns Hop-kins Press, Baltimore, Maryland, 1966.

Descriptors: *Alternative costs, *Maryland, *Virginia, *Water quality, *Water management, *Dissolved oxygen, Cost-benefit analysis, Costs, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S., Management.

The author describes a study of the cost of alternative systems for dissolved oxygen management in the Potomac Estuary being conducted by Resources for the Future, Inc. He explains the theoretical basis and strategy of the study and presents preliminary cost estimates of achieving a specified goal for dissolved oxygen by a number of alternative methods. W69-03643

SOME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT, For primary bibliographic entry see Field 05D. For abstract, see .

W69-03644

DELAWARE ESTUARY COMPREHENSIVE STUDY--PRELIMINARY REPORT FINDINGS.

Report, Federal Water Pollution Control Administration, Department of the Interior, Washington, D. C., June 29, 1966.

Descriptors: *Water quality control, *Cost-benefit Jersey, Employment, Forecasting, Ecology, Control, Quality control, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters, Atlantic coastal plain, Delaware, Economic prediction, Coastal plains, Geographical regions,

This is a preliminary report which consists of a general review of the Delaware Estuary Comwater quality goals, costs, and benefits and control schemes that were considered. The study covers the length of the Delaware River from Trenton, New Jersey, to Liston Point, Delaware. W69-03645 prehensive Study together with the alternative

'STATEMENT', Federal Water Pollution Control Administration, Atlanta, Ga.

Jack Different.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Transcript of Public Meeting, Biloxi, Mississippi, January 17, 1968, pp 6-8.

Descriptors: *State governments, *Planning, *Mississippi, *Gulf of Mexico, *Water pollution effects, Water pollution control, Commercial fishing, Recreation, Fishing, Industries, Bodies of water, Gulfs, Surface waters, Governments, Coastal plains, Geographical regions, Regions, Gulf coastal plain, Southeast U. S.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G-Water Quality Control

The Gulf Regional Planning Commission identifies four estuarine zones: (1) Pascagoula River, with a drainage basin which contains densely developed urban areas, industrial concentrations, and extensive marsh areas; (2) Biloxi Bay, surrounded for much of its length by urban development, a planned industrial area, and a major steam-generating electric power station; (3) Bay of St. Louis, also flanked in part by urban development, only limited areas of which are adequately served by sanitary sewage collection, treatment, and disposition treatments; (4) Pearl River, a major stream with a number of urban centers and industrial installations of its middle reaches. The Regional Planning Commission is primarily concerned with the degrading effects of estuarine pollution on (1) commercial fisheries, including shellfish, (2) recreation, and (3) aesthetics, including real estate values. W69-03649

RESEARCH PROBLEMS IN WATER QUALITY AND RECREATION.

Conference on Water Quality and Recreation in Ohio, Water Resources Center, The Ohio State University, Columbus, Ohio, June 15, 1966.

Descriptors: *Water quality control, *Recreation, Descriptors: "Water quality control, "Recreation, Water resource development, Control, Quality control, Resource development, Water pollution, Water pollution effects, Cost-benefit analysis, Water management (Applied), Management.

About \$107 million were budgeted for water resources research for the 1967-68 fiscal year. There were two directions being pursued in research in water quality management: (1) To decrease the amount and potency of pollution reaching stream channels, and (2) To handle waste streams and receiving waters so as to minimize deleterious effects. Cost-benefit evaluations of recreation programs are more difficult to maintain than an evaluation of the benefits of water quality management. There are many problems involved in such an attempted evaluation. W69-03653

THE MOLLUSCAN SHELLFISH INDUSTRY.

CURRENT STATUS AND TRENDS, For primary bibliographic entry see Field 06B. For abstract, see . W69-03659

METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY PROGRAM, For primary bibliographic entry see Field 05B. For abstract, see . W69-03667

'GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE NATIONAL ESTUARINE STUDY REPORT', Federal Water Pollution Control Administration,

Atlanta, Ga.

Atlanta, Ga.
R. S. Howard.
In CLEAN WATER FOR THE NATION'S
ESTUARIES, Proceedings of the Georgia Public
Meeting, Jekyll Island, Georgia, February 29,
1968, pp 1-4.

Descriptors: *Water quality control, *Georgia, *Pollution abatement, *Sewage, *Sewage treatment, *Industrial wastes, *Legislation, Radioactivity effects, Fish, Shellfish, Water pollution treatment, Water treatment, Control, Quality control, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Zoning, Toxicity, Pesticides, Marshes, Wetlands, Abatement, Waste treatment, Tidal marshes, Social values, Wastes, Economic impact, Values, Aesthetics. impact, Values, Aesthetics.

Georgia has 2000 square miles of estuarine zone (including salt marshes) on 115 miles of seacoast. Seafood production has declined drastically in the

last 40 years due to contamination and pollution from sewage and industrial pollution. The State
Water Quality Control Board makes the following water Quality Control Board makes the following recommendations for the preservation of estuarine water quality: (1) Federal and state governments should clean up existing pollution from sewage and industrial wastes, (2) Undertake research on the effects of the control of the industrial wastes, (2) Undertake research on the effects of pollutants, from sewage and industrial wastes, on the marine biota of estuaries, (3) Investigate the possibility of blending certain waste discharges to offset individual pollutional effects, (4) Conduct social and economic studies to develop the values of estuaries for various uses and for aesthetic considerations, and determine the for aesthetic considerations, and determine the practicality of the zoning concept as opposed to the multiple use philosophy, (5) Establish a pesticide monitoring and sampling program, especially through the spring and summer seasons, (6) Develop a shellfish and fish sampling program to study the effects of radiation and pesticides on fish, shellfish, and other marine life, and (7) Determine the volume and patterns of flows in tidal basins. W69-03679

SEATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES.

W. Isaac, and Curtis P. Leiser 32nd North American Wildlife and Natural Resources Conference, San Francisco, California, Transactions, March 13-15, 1967, pp 127-137.

Descriptors: *Washington, *Sewage treatment, *Water pollution control, Pacific northwest U. S., Civil engineering, Waste treatment, Engineering, Algae, Plants, Control, Pollution abatement, Abatement, Pacific coast region, Regions, Geographical regions, Bays, Bodies of water.

Citizens in the Seattle area, which is comprised of 14 cities, initiated the legislation and voted into being a metropolitan municipal corporation, specifically to deal with the pollution problem, but able also to expand to alleviate other regional difable also to expand to alleviate other regional difficulties as they would arise. An operating treatment agency and four engineering firms composed a master plan which is detailed in this paper. The cost of the plan was estimated at \$125,000,000. cost of the plan was estimated at \$125,000,000. The pollution control program will continue in three major parts: (1) Emission controls applied to industrial waste discharges at the source, (2) Treatment plant control and monitoring by personnel at tached permanently to plant operations, (3) A separate force to monitor the receiving waters for biological nutrient and physical parameters. W69-03683

06. WATER RESOURCES **PLANNING**

6A. Techniques **OF Planning**

For abstract, see .

AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERA-TION OF STREAMFLOW, Washington Univ., Seattle; and Washington Water Research Center, Pullman.
For primary bibliographic entry see Field 02A.
For abstract, see .

W60.0307

W69-03307

ANALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02F. For abstract, see . W69-03310

A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES, Rice (Cyrus W.) and Co., Pittsburgh, Pa. For primary bibliographic entry see Field 06C.

W69_03322

TECHNIQUES OPTIMIZATION HYDROLOGIC ENGINEERING,
Corps of Engineers, Sacramento, Calif. Hydrologic

Engineering Center. Leo R. Beard.

FOR

Water Resources Res, Vol 3, No 3, pp 809-815, 1967. 7 p, 1 fig, 9 ref.

Descriptors: *Optimization, *Systems analysis, *Digital computers, *Hydrologic aspects, *Water resources, Water utilization, Planning, Engineering, Model studies, Computer models. Identifiers: *Hydrologic engineering, Optimization

procedures

Optimization processes show considerable promise for a reasonable solution of the increasingly com-plex design and operation problems that occur in plex design and operation problems that occur in water resources engineering. Gradient methods of optimization should appeal to the engineer, because the methods can be used within the framework of traditional engineering analyses (e.g., multipurpose sequential routing or system simulation), where the components of the system can be changed in successive trials to obtain the best combination most rapidly. They can most easily be adapted to practical complex problems and appear to require minimum programming and computa-tion time. Because of the large amount of computa-tion involved, optimization procedures almost al-ways require the use of high-speed digital compu-W69-03329

SELECTED BIBLIOGRAPHY ON HYDROLOGI-CAL CONTROL BY RESERVOIR OPERATION, For primary bibliographic entry see Field 04A. For abstract, see. W69-03376

ANALYSIS OF A WATER STORAGE RESERVOIR SYSTEM.

For primary bibliographic entry see Field 04A. For abstract, see. W69-03377

LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES, For primary bibliographic entry see Field 04A. For abstract, see .

W69-03379

IMPACT OF INSTITUTIONAL ARRANGE-MENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER AL-LOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN, Battelle-Northwest, Richland, Wash.; and

Northwestern Univ., Evanston, Ill.
Jmes P. Heaney, Robert S. Gemmell, Abraham
Charnes, and Harold B. Gotaas.
Proc Third Annual Amer Water Resources Conf,
pp 84-91, 1967. 8 p, 3 tab.

Descriptors: *Institutional constraints, *Water allocation (Policy), Planning, *Water pollution control, *Colorado River Basin, Beneficial use, Water policy, Water law, Colorado River Compact, Economic impact, Mathematical models, *Water resources development, Arid lands, Water quality, Interstate compacts, Public rights, River basin development, Irrigated land.

Selected results were presented from mathematical programming model for river basin planning that was applied to the Colorado River Basin. The primary mechanism for allocation of water has been the Colorado River Compact. The analysis made assumed intrastate allocation followed optimal allocation dictated by the model, which was not the case. Effect of water quality and public policy on water allocation were also reviewed. (Affleck-Arix) W69-03492

Evaluation Process—Group 6B

FINITE DIFFERENCING METHODS,

Agricultural Research Service, Beltsville, Md. Hydrograph Lab.

For primary bibliographic entry see Field 07C. For abstract, see . W69-03519

TIME SERIES ANALYSIS,

Geological Survey, Arlington, Va. N. C. Matalas. Water Resources Res, Vol 3, No 3, pp 817-829, 1967. 13 p, 28 ref.

Descriptors: *Time series analysis, *Hydrologic aspects, Statistical methods, Forecasting, Correlation analysis, Stochastic processes, Mathematical

Identifiers: Hydrologic sequences.

A characteristic feature of hydrologic events is that they are not independently distributed in time. The degree of linear dependence between events k time units apart is measured by the serial correlation coefficient. This correlation, which tends to decrease with an increase in k, is attributed to storage processes in the atmosphere or within the drainage basin. The correlation measures the degree of redundancy of information yielded by each hydrologic event. This redundancy implies that statistical parameters computed from a sequence of events are less reliable than is indicated by the sequence length. Hydrologic sequences are formulated in terms of generating models to account for serial dependence between events, to allow prediction of events at future time points, and to assess the effect of serial dependence on hydrologic studies. W69-03524

VARIANCE SPECTRUM ANALYSIS,

National Center for Atmospheric Research, Boulder, Colo.
Paul R. Julian.
Water Resources Res, Vol 3, No 3, pp 831-845, 1967. 15 p, 6 fig, 27 ref.

Descriptors: *Time series analysis, *Hydrologic aspects, *Statistical methods, Correlation analysis, Stochastic processes, Random processes, Hydrolo-

ldentifiers: Hydrologic systems, Spectral analysis, Variance spectrum analysis.

An annotated review of the use of variance spectrum analysis for hydrological problems is presented. Spectrum and cross-spectrum analyses may be used to analyze random or stochastic components in time and space series. Time-series techniques are used to allow the interdependence of successive observations to be taken into account in using standard statistical tests that assume independent observations, to account for interdependence of observations in terms of the physical causes of phenomena, and to predict future values of the time series. Nonrandom components in of the time series. Nonrandom components in hydrological time series, for instance, periodic changes of concentrations of pollutants in estuaries, may easily be found. Several other examples of revealed periodicities are given. Spectral techniques may be used in digital generation of streamflow records. (Knapp-USGS) W69-03525

DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN, Battelle Memorial Inst., Columbus, Ohio. For primary bibliographic entry see Field 06B. For abstract, see . W69-03570

OPTIMAL CONTROL OF LINKED RESER-

VOIRS, Water Planning for Israel Ltd. Tel Aviv; and Water Research Association, Medmenham (England).

Z. Schweig, and J. A. Cole. Water Resources Research, Vol 4, No 3, pp 479-497, June 1968. 19 p, 3 fig, 5 tab, 13 ref.

Descriptors: *Computers, Constraints, *Conjunctive use, Digital computers, Dynamic programming, Inflow, *Reservoirs, Storage.

Identifiers: *Linked systems, Frequency distribution, *Optimal control policies, Matrices, Serial

correlation.

Control rules for linked reservoirs meeting a common demand are evaluated for a two storage case. Draw-off can be made from either of the reservoirs directly to supply, and transfers are permitted from the smaller to the larger reservoirs. Dynamic programming is effective in selecting the optimal control rules, for any stage of reservoir contents, given a defined objective of operation. The objective is expressed in monetary terms, relating to transmis-sion, purification, or shortage costs, which are to be minimized in the long term. The case considered allows monthly inflows to the reservoirs to be treated as random variates; first order serial correlation of inflows is expressed by using 'high' or 'low' inflow distributions, according to whether the previous month's inflow was above or below its mean. Present worth factors, switch-on costs, and costs of shortage that vary nonlinearly with total deficit can all be brought into the reckoning. W69-03571

OPTIMIZATION OF BRANCHING MULTISTAGE SYSTEMS: A REPLY TO A COMMENT BY D P LOUCKS, Texas A and M Univ., College Station; and Texas

Univ., Austin.
W. L. Meier Jr., and C. S. Beightler.
Water Resources Research, Vol 4, No 6, pp 1385-1386, December 1968. 2 p, 7 ref.

Descriptors: *Optimization, *Dynamic programming, Linear programming. Identifiers: *Multistage structure, *Partial op-timization, Nonlinear programming, Simultaneous optimization, Lagrange multiplier.

Water resource systems and their component subsystems usually exhibit multistage structures. Although their complexity and high dimensionality tax the capacity of our sophisticated analytical techniques and computational equipment, the par-tial optimization procedure of dynamic pro-gramming affords the ability to effect the optimization of complex structures recursively. This decomposition can often make a seemingly impossible problem tractable. Loucks misinterprets the authors' intent pertaining to linear and nonlinear programming. The authors feel linear programming can be used for water resource problems if the objective function and all constraints are linear, or if jective function and all constraints are linear, or if the nonlinearities of the objective function or con-straints can be approximated via linear functions. The use of the Lagrange multiplier is not practical in complex problems. Unlike simultaneous op-timization techniques, where all decision variables are directed toward their optimum values simulare directed toward their optimum values simul-taneously, partial optimization, of which dynamic programming is an example, decomposes the problem into simpler subproblems which are analyzed sequentially by partially optimizing single, or groups of, variables while the effects of interac-tions among the variables are maintained. (Loeb-Puteers) Rutgers) W69-03580

SIMULATION OF A WATER RESOURCES SYSTEM,
Washington Univ., Seattle. Fisheries Research Inst.
Donald E. Bevan, and Gerald J. Paulik.
Washington Water Research Center, Completion
Report, February 5, 1969. 11 p. OWRR Project A003-Wash.

Descriptors: *Computer, Flow, Water quality, Estuaries, Fish populations, Fish management, Systems analysis, Simulation analysis, Simulation, Computer models, Washington.

Project goals were to develop theory and methodology needed for computer simulation modeling of water resource systems with significant

biological components. Research completed under botogical components. Research completed uncurrent project is summarized below: (1) A series of simulation models representing population dynamics of a freshwater zooplankton population was developed in DYNAMO. (2) The problem of determining maximum sustainable physical yield from a mixture of fish stocks of differing sizes and productivities was analytically solved, and FOR-TRAN IV programs were written in which solution was employed. (3) A computer simulation model of seaward migration of fish through a river and estuary was written in DYNAMO. (4) A DSL-90 computer simulation model of flow in a series of contiguous reaches of a river was developed. (5) A system for processing and analyzing data obtained from automatic water quality monitors in order to provide necessary information for proper management of an estuary was developed. (Lenarz-Wash) W69-03601

'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION EQUATION',

Stanford Univ., Calif.

For primary bibliographic entry see Field 02L. For abstract, see. W69-03675

'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY POLLUTION',

Stanford Univ., Calif. For primary bibliographic entry see Field 05A.

For abstract, see . W69-03690

6B. Evaluation Process

DELAWARE RIVER BASIN COMPACT.

N Y Conserv Law sec 801 (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Federal government, Adminis-trative agencies, Conservation, Water resources, Planning, *Water resources development, Water supply, *Water policy, Administration, Delaware, Pennsylvania, New Jersey, United States, Public benefits, *River basin commissions, Legal aspects.

The Delaware River Basin Compact was adopted for the purposes of the conservation, utilization, development, management and control of the basin. It was thought that comprehensive multiple purpose planning would bring the greatest benefits and produce the most efficient service in the public interest. The program, as administered by a basin-wide agency, should provide flood damage reduc-tion; conservation and development of surface and ground water supply for municipal, agricultural, and industrial uses; development of water recreation facilities; promotion of forest land management, soil conservation, and watershed projects; protection and aid to fisheries; development of hydroelectric power potentialities; control of salt water movement; abatement and control of water pollution; and regulation of streamflows aimed at attaining these goals. Members of the compact include New York, Delaware, New Jersey, Pennsylvania, and the United States. The federal governvania, and the Onited States. The rederal govern-ment, recognizing a national interest in the basin, has authorized the Army Corps of Engineers, with the aid of the departments of Agriculture, Com-merce, Health, Education and Welfare, Interior, and the Federal Power Commission, to make comprehensive surveys and reports concerning the waters of the basin. Concurrent legislation was passed by all members in order to create the compact. (Scott-Fla) W69-03299

INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.
Available from the Superintendent of Documents, U. S. Gov't Printing Office, Wash., D. C., at \$60 per set. Sold in sets only. Washington; U. S. Gov't Printing Office, 1968, 8 vols.

Group 6B—Evaluation Process

Descriptors: Water Resources Planning, *Water Management, *Water Desalination, Groundwater. Management, "Water Desamlation, Orosindader, Flood Control, Irrigation, Water Pollution, Weather Modification, Water Conservation. Identifiers: *Water for Peace, International Water Conference

The purposes of the conference were to identify water problems, exchange knowledge, discuss goals and explore action programs in the furtherance of a worldwide cooperative effort aimed at the solution of water problems. More than 600 technical papers were accepted for publication by the conference. Of these, 193 were presented orally. Also included were 52 'Country Situation Papers,' which described water problems of various nations, solutions attempted and proposed plans for the future. The following topics were covered: Basic Data for Water Programs; Concepts and Prodecures; Desalting; Economic Considerations; Education and Training for Water Programs; Evaporation Control; Financing Considerations; Flood Control; Geoeconomic; Governmental Agencies; Ground-water; Inland Waterway Transportation; International Agencies; International Programs; Irrigation; Maintaining Water Quality; Multiple Purposes; Needs and Programs; Organizing for Water Programs; Piping Design; Planning and Developing Water Programs; Pollution Control; Reuse of Water; Role and Development; Systems and Analyses; Water Conservation Techniques; Water Analyses; Water Conservation Techniques; Water Law and Legislation; Water Quality Considerations; Water Quality Control; Water Quantity Forecasting; Watershed Management; Water Supply; Water Supply Technology; Water User Agencies; Water User Education; and Weather Modification. W69-03305

HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN RUMANIA

(IN RUMANIAN), National Council of Engineers and Technical Scientists, Bucharest (Rumania).

Scientists, Bucharest (Rumania). Gheorghe Platagea. Hidrotehnica, Gospararirea Apelor, Meteorologia, (Bucharest) Vol 12, No 7, pp 356-358, Jul 1967. 7 tab, 2 graphs, 6 ref.

*River basin development. *Hydrologic data, Infiltration, Runoff, Water loss, Evapotranspiration.
Identifiers: *Rumania, *Jiu River, Hydrographic

Hydrological research in Rumania is conditioned by such factors as construction requirements and by such factors as construction requirements and volume of investments. Research in the period 1957-1965 covered 1,451 parameters concerning maximum-, average-, and minimum discharge rates and related hydrological factors. Typical of such analyses were: the Jiu basin for a 15-year period to measure daily average discharge and volume; maximum discharge during 1961-66 for 6 hydrographic systems; and daily discharge according to volume for a one-year period at 13 hydrographic stations. To justify economic expenditures, gaps in knowledge were investigated about such phenomena as: infiltration, water loss to soil, enphenomena as: infutration, water loss to soil, environmental conditions on ground and surface water, surface water loss through evapotranspiration, subsurface runoff, and related hydrological factors in the geographical area. The research generated by economic requirements will serve as a basis for completing the projected hydrological data network in Rumania. (Llaverias-USGS)

OPTIMIZATION TECHNIQUES HYDROLOGIC ENGINEERING,

Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center. For primary bibliographic entry see Field 06A.

For abstract, see . W69-03329

POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
Federal Water Pollution Control Administration,
Washington, D. C.

For primary bibliographic entry see Field 05G. For abstract, see . W69-03410

REGIONAL WATER RESOURCE DEVELOP-MENT IN THE FEDERAL SYSTEM,

W. Kiechel.

For eight vol. Proceedings see this issue, Field 06B, W69-03305. International Conference on Water For Peace, Vol 5, pp 628-636 (1968), 9 p.

Descriptors: *Water conservation, *Water resources development, *Regional analysis, *Georesources development, 'Regional analysis, 'Geo-graphical regions, Project purposes, Climatic zones, State governments, Government finance, inter-agency co-operation, TVA project, Legisla-tion, Project planning, Interstate compacts, In-terstate commissions, Interstate rivers.

In order to effectively develop and preserve our water resources, we must develop a system of re-gional control. To be effective, regionalism must proceed beyond planning. It must cut across all levels of government institutions. Some executive agencies working in the area of water resource development have long been organized on a regional basis. Any arrangement must be integrated with the federal system and made consistent with the constitutional and legal framework thereof. Legal institutions and concepts of water law differ from state to state, yet water flows and precipitates without regard to national, state, or local boundaries. A senate committee found that by 1980 five major regions of the United States will have an inadequate water supply. Other areas will have adequate water only if they invest billions in pollution control, storage reservoirs, and recycling. The evolution of different systems of water law in the various states demonstrates how traditional legal institutions have been influenced by climatic conditions. The climate governs and controls the water supply in given regions; hence, the need for re-gional water resource development. The only effec-tive program will be a federal-state program designed to balance the varying needs of the re-gions on a national basis. The national program must be responsive to regional, state, and local needs. (Stewart-Fla)
W69-03411

CONSERVATION AND WATER RESOURCES

PLANS.
N Y Conserv Law sec 835 Art 14 secs 14.1, 14.2 (McKinney Supp 1968).

Descriptors: *New York, *Conservation, *Water resources, *Planning, Civil law, Legislation, State governments, Administrative agencies, Natural resources, Water conservation, Water quality, Long term planning, Water resources development, Public utilities, Basins, Water quality control, Legal aspects.

The conservation commission shall adopt and The conservation commission shall adopt and develop a comprehensive plan for immediate and long range development and use of water resources of the basin. This shall include all public and private facilities thought necessary. Before the plan is adopted, the commission should hold public hearings, consult with water users, public bodies, and public utilities and consider their recommendations. Any private or public facilities may be and public utilities and consider their recommendations. Any private or public facilities may be added to the plan based solely on the discretion of the commission provided they do not or would not significantly affect the water resources of the basin. The commission should also adopt a water resources program based on the above comprehensive plan. This water resources plan should deal with the quality and quantity of water resources needed for the period of the plan and the existing and proposed facilities required to satisfy such needs. A separate statement of the projects proposed to be undertaken by the commission should also be made. (Scott-Fla) W69-03463

SOLVING THE ARID STATES' PROBLEMS, California State Dept. of Water Resources, Sacra-

William R. Gianelli.

Proc Third Annual Amer Water Resources Conf, Amer Water Resources Assoc, pp 23-27, 1967. 5 p.

Descriptors: *Arid lands, *California, Colorado River, Interstate compacts, *Water transfer, Water utilization, Surplus water, *Water resources development, Pumping plants, Aqueducts, Southwest U.S., Water law.
Identifiers: Central Arizona Project, North Coastal River Project (California).

A variety of programs used and planned by California to solve its water problems were discussed. The first was the State Water Project which transports surplus water from northern California to the heavily populated areas of southern California heavily populated areas of southern California utilizing a system of aqueducts and pumping plants. By 1972 this project financed by 31 agencies will bring adequate water as far as San Bernardino County and continue to do so until 1990. The second was the North Coastal River project which will provide additional water in 1985. The third was the Central Arizona Project which was discussed with respect to legislative problems and lack of cooperation among southwestern and western states. (Affleck-Ariz) W69-03493

URBAN WATER RESOURCES RESEARCH; SYSTEMATIC STUDY AND DEVELOPMENT OF LONG-RANGE PLANS, FIRST YEAR RE-PORT, SEPTEMBER, 1968.

American Society of Civil Engineers, New York. Urban Hydrology Research Council.

New York, American Society of Civil Engineers, 1968, various paging. OWRR Contract No. 14-01-0001-1585.

Descriptors: *Rainfall-runoff relationship, *Urbanization, *Systems analysis, *Drainage engineering, Data collection, Storm runoff, Urban sociology, Community development. Identifiers: *Urban hydrology.

Systematic study and development of long-range programs by the ASCE Urban Hydrology Research Council for the OWRR are described and cover the Council for the OWRR are described and cover the first year of work. Objective of the research is to provide guidelines for initiating and expanding long-range studies in urban water problems. The U. S. Geological Survey is studying data requirements. First year emphasis was on subjects requiring earliest consideration, such as urban storm drainage. est consideration, such as urban storm drainage. An assessment is given of the potentials, liabilities, and available knowledge of the rainfall-runoff-water quality process; and model requirements for process simulation are detailed. Immediate research needs with regard to damage evaluation are given; and the utilization of storage to ameliorate flooding is outlined. The principal non-hydrologic aspects of urban water are listed, and include administration of works, economics of planning and operation, financing of systems, recreational facilities, planning and operation, and sociological problems. Report contains 11 appendices, each with technical papers dealing with the appendix subject. (Lang-USGS)

DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN, Battelle Memorial Inst., Columbus, Ohio, H. R. Hamilton, S. E. Goldstone, and F. J. Cesario. Battelle Memorial Institute, Columbus, Ohio, 1966. 336 p, 111 tab, 89 fig, append.

Descriptors: *Model studies, Computer models, Mathematical models, Regional analysis, Regions, River basins, River basin development, Forecasting, *Economic predictions, Water resources,

Evaluation Process—Group 6B

Water quality, Water shortages, Population, Human population, Employment, Planning, In-come, Water supply, Water utilization, Industries. Identifiers: *Susquehanna River Basin, Economic growth, Dynamic model, Demographic charac-

This report summarizes a three-phase research program in which a dynamic, mathematical model of the economy of the Susquehanna River Basin was developed. The model is capable of generating developed. The linder is capacite of generating economic and water-use projections for the Basin under a wide variety of alternative assumptions. The following are the major conclusions of the research: (1) the water resources of the Basin appear adequate to support economic growth for the foreseeable future without the construction of major systems if river works; (2) the water quality in the Basin is generally good except for the occur-rence of acid-mine drainage in the West and North Branches; (3) water shortages are caused more by an insufficiency of investment in water treatment and distribution systems than by a shortage of water resources and (4) the usefulness of computer simulation for regional economic and regional resources studies has been demonstrated. W69-03570

NATIONAL JURISDICTION AND THE USE OF THE SEA,

Commission on Marine Science, Engineering and Resources, Washington, D. C. Lewis M. Alexander. National Resources Journal, Vol 8, No 3, pp 373-

400, July 1968. 28 p.

Descriptors: *Water utilization, Jurisdiction, Legal aspects, *International law, International waters, Transportation, Commercial fishing, Mining, Military aspects, Water resources, United States.
Identifiers: National jurisdiction Section Scientific research.

The United States uses the sea for transportation, commercial fishing, mining, scientific research and military operations. The nature and extent of the country's jurisdiction in the marine environment is of prime importance because of the effects this jurisdiction has on its opportunities for the use of the sea's resources. US policy on jurisdictional matters in the sea rests on two principal bases: the international regulations contained in the four Geneva Conventions, and the bilateral and multilateral agreeements which this nation has made with other states concerning specific uses of the sea. The economic, scientific and military uses which most countries including the US are not seriously hampered by inadequate international rules and regula-tions at the present time. However, there is reason to anticipate future problems. W69-03572

BENEFIT COST ANALYSIS: A METHOD TO DEMONSTRATE THE IMPORTANCE OF WATER RESOURCES DEVELOPMENT, Carruth J. Wagner.

Carruin J. Wagner. For 8-Volume Proceeding see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 7, 1968, pp 189-193. 5 p, 3 ref.

*Cost-benefit analysis, planning, Water resource development, Planning, *Public health, *Budgeting, Constraints. Identifiers: American Indians, Alaska natives.

Monetary resources of the world are generally insufficient to develop fully all human and natural resources during a short span of time. Therefore, competition will continue to exist in obtaining financial support to develop such resources, including water resources. The ability of water resources developers to meet that competition will largely determine that portion of total available financial resources that is committed to water development. A scheme of planning consisting of nine sequential steps is presented: One step, benefit-cost analysis, is considered in a simplified form to illustrate the

process. Three alternative plans of action are presented and the benefits versus the cost of each are compared for the purpose of selecting the most favorable plan of action. W69-03574

PUBLIC OBJECTIVES IN WATER RESOURCES DEVELOPMENT,

Gus Norwood.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Converence on Water for Peace, Vol 6, 1968, pp 738-47. 10 p.

Descriptors: *Water resources development, Planning, Water policy, Federal project policy, Costs, Discount rate. Identifiers: Opportunity cost.

Long term, overall benefits to society suggest a public policy of optimum development of water resources or at least leaving the door open so as to permit future optimum development. Continued accelerating population growth and the loss of natural resources point toward optimum development as an imperative public policy. General public objectives of the efficient use of water resources on a balanced, multiple purpose basis for 'the greatest good of the largest number of people for the longest time' might include other specific public ob-jectives which might govern the timing of construction, such as consideration of fiscal policy, full employment, balance of trade, income redistribution, expansion of the public and private economy and opening new areas for human habitation. Such objectives generally cannot be met under the narrow classical economics of the market place 'opportunity cost of money.' (Winn-Rutgers)
W69-03575

APPLICATION OF MARGINAL ECONOMIC ANALYSIS TO RESERVOIR RECREATION

PLANNING, Kentucky Univ., Lexington. Water Resources Inst. John Ellis Sirles, III.

Water Resources Institute, Research Report No 12, 1968. 99 p, 19 tab, 14 fig, 31 ref. OWRR Project A-006-KY.

Descriptors: Recreation demand, Recreation facilities, Reservoir design, Reservoir sites, Reservoir storage, Marginal costs, Benefits, *Resource storage, Marginal costs, Benefits, *Resource development.
Identifiers: Capacity coefficients, Crowding, *Visitation rates, Esthetic values, Potential visitation for the coefficients of t

tion, *Outdoor based recreation.

Recreation visitation and cost data at three reservoirs in the Ohio River Valley (Rough River, Dewey, and Winton Woods) were analyzed in an attempt to derive a method by which the optimum level of reservoir recreation development could be determined by marginal economic analysis. The visitation data were used to estimate annual cost and marginal costs as functions of annual visitation.

Marginal cost and marginal benefit data were combined to find the optimum size. Potential visitation to Winton Woods was estimated, and the marginal benefit per visitor was estimated from travel costs. The potential visitation was combined with the distribution factors for Rough River and Dewey to get the time distribution for reservoir use. Actual visitation was combined with the distribution factors at Winton Woods to get the time distribution for at winton woods to get the third untotation of use at actual conditions. This allowed reduction in potential benefits due to crowding to be estimated. Marginal cost curves are combined with marginal benefit curves to find the optimum visitation of the optimum implies a required tion to a site. This optimum implies a required reservoir size which can be estimated by use of the distribution factors and capacity coefficients. (Sokoloff-Rutgers) W69-03576

ESTIMATION OF RECREATIONAL BENEFITS AT SOME SELECTED WATER DEVELOPMENT SITES IN CALIFORNIA, Planmetrics, Berkeley, Calif.

Leonard Merewitz

Berkeley, Calif, Planmetrics, 1968. 66 p, 2 fig, 27

Descriptors: Recreation, *Recreation demand. Benefits, Recreation facilities, Market values, Value, Income, Population, Human population,

Identifiers: *Recreation benefits, Consumer surplus, Recreation substitutes.

The major results of this study of six water development sites are as follows: (1) estimates on the extent to which cost discourages attendance at the sites were obtained, (2) population size, population density and income were other variables used to explain attendance, (3) the availability of recreation substitutes, as defined in this study, did not in-fluence attendance, (4) ownership of water craft appeared to influence water-based recreational attendance, (5) the consumers' surplus estimates obtained were about two and one-half times larger than the market value estimates of the benefits and (6) market value calculations for the five sites in California showed that the prices which would maximize revenue were potentially collectible. The variance in these prices suggested that uniform prices should not be charged. (Winn-Rutgers) W69-03578

ECONOMIC VALUE OF IRRIGATION WATER, Angel M. Maqueda.

For 8-Volume Proceedings see this issue, Field 06B, W 69-03305. Int Conference on Water for Peace, Washington, 1968, Vol 6, pp 722-728. 7 p,

Descriptors: Farm management, *Investment, *Irrigation programs.
Identifiers: *Value, *Arrid lands, Factor of produc-

In arrid countries irrigation water is the principal limiting factor in agricultural production. The costs of the irrigation water do not reflect the economic importance of such water to the national economy. The minimum value of irrigation water is the sum of the annual costs of implementing the irrigation project plus annual operating and maintenance costs. The maximum value of irrigation water is the minimum value plus the difference in profits obtained from crops grown on irrigated land and those which result from crops grown on the same land without irrigation. There are three different amounts for the value of water: a minimum amount which is the rate charged for irrigation, a maximum amount which would attribute to the irrigation water, the increase in profits; and, a weighted value which attributes only a part of the increase in profits to the irrigation water. (Grossman-Rutgers) W69-03582

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,

Ralph Porges.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 47-60, 1968. 14 p, 4 fig.

Descriptors: *Water quality control, *Delaware River Basin Commission, *Standards, *Administration, Conferences, Publications, Municipal wastes, Industrial wastes, Waste treatment, Pollution, Interstate commissions, Interstate compacts, Dissolved oxygen, Oxygen deman, Administrative agencies, Water pollution control, Cities, Waste disposal, Water resources development. Identifiers: Delaware River Basin Compact.

The Delaware River drains a region of ample water resources. Many water quality problems exist encompassing protection of municipal and industrial water supplies, acid mine drainage control, recreations of the control of the contro water supplies, acid mine drainage control, recleation, saline waters' encroachment, natural shellfish beds, maintenance and passage of fish and the discharge and disposal of the generally treated wastes from people and industries. Control mechanisms include federal, state, and local agen-

Group 6B—Evaluation Process

cies. Municipalities and industry have participated by waste management programs. The Delaware River Basin Commission was created by the four basin states in 1961. Part of the Commission's responsibilities is the maintenance of a comprehensive plan of water resources development, including water quality management. The federal Water Pollution Control Act of 1965 requires the states to hold public hearings to determine the water uses of interstate streams, establish stream criteria, and interstate streams, establish stream criteria, and develop an implementation program. The states and the Commission are undertaking to develop a water quality management program. Water quality standards have been adopted for the estuary and bay which, after approval by the Federal Water Pollution Control Administration, will be implemented. (Childs-Fla) W69-03583

PLANNING FOR MULTI-PURPOSE DEVELOP-MENT OF WATER AND RELATED LAND RESOURCES IN THE UPPER MISSISSIPPI RIVER BASIN,

James S. King.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 445-454, 1968. 10 p.

Descriptors: *Multiple purpose, *Mississippi river basin, *Resource allocation, *Water resources, Conferences, Publications, Planning, Land resources, Model studies, Decision making, Administration, Investment, Economic efficiency, Water conservation, Water quality, Water supply, Multi-purpose projects, Water resources development, Project planning.

Comprehensive water and related land resource planning in the upper Mississippi River Basin is a technique of decision-making pertaining to the allocation of scarce resources among competing claims. The ultimate objective of planning is to provide a sound basis on which public investment decisions can be made. The study discusses various principles and problems of planning. First, flexibility must be maintained even though the broad objective is long-range national efficiency. Second jective is long-range national efficiency. Second, there must be a clear definition of the overall study objective to permit development of criteria for the field planning group's use. Third, no specific ap-proach is appropriate for all studies. Fourth, clear channels of communication must be maintained. Fifth, the hydrological boundary is the most logical study boundary. Sixth, there is difficulty in maintaining interest among participants. Seventh, for efficient comprehensive studies a separate task force in a central location should be created. Eighth, there must be recognition that alternative means may reach the same goals. Ninth, planning for planning's sake is inadequate. Finally, development of water and related land resources in relation to potential and needs distinguishes the river basin approach from single-purpose water development. (Childs-Fla) W69-03586

PLANNING. FOR MULTIPLE-PURPOSE DEVELOPMENT, Joseph L. Ignazio.

For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 455-468, 1968. 14 p.

Descriptors: *River basins, *Multiple-purpose, *Project planning, *Water resources, Conferences, Publications, Administration, Water development, Interstate rivers, Floods, Pollution, Water supply, Droughts, Encroachment.

Identifiers: Connecticut River Basin, Connecticut River Study, Federal Water Resources Planning

Through the use of comprehensive planning for the Connecticut River Basin, water management problems can be more adequately handled. Some of the current problems are in the resource areas of flood control, land management, navigation,

recreation, water supply, low flow augmentation, water quality and the outstanding problem of pollution. The broad objectives of this study are to establish a plan for the best way to utilize water in the basin. Developmental problems have been divided into four topics: natural, man-made, institutional, and economic. Study management problems occur largely in the delineation, selection and coordination of the various efforts made by the participants. The manager of a water resources study has various planning tools to reconcile the supply and demand for water resources: economic projections, supply and demand analysis and system analysis techniques. Tributaries with a sizable natural surface supply, through proper storage and regulations of flow, can permit a higher stream use. The recommended basin plan will be made of several integrated projects divided into those developments for urgent consideration or a timetable of 1980 and will indicate potentials to meet needs through the year 2020. (Childs-Fla)
W69-03587

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,

Illinois Univ., Urbana. Dept. of Agricultural

For primary bibliographic entry see Field 06E. For abstract, see . W69-03590

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN IL-LINOIS.

Corps of Engineers, Chicago, Ill.

U.S. Army Engineer Division, North Central, Chicago, Illinois, 1967, 90 pp, 1 map, 31 photo, 6

Descriptors: Illinois, Basins, Developed waters, *Navigation, Flood protection, Shore protection, Repairing, Costs, *Water resources development, *Project planning, *Channel improvements. Identifiers: Army Corps of Engineers.

The report describes projects completed in Illinois by the Army Corps of Engineers, projects un-derway, active authorized projects, navigation pro-jects under special continuing authorities, flood plain information studies, and survey investigations underway. Projects completed include sixteen navigation projects, seventy-one flood control projects and Devil's Kitchen Dam. Eight navigation jects and Devil's Kitchen Dam. Eight navigation projects, twenty-eight flood control projects and a beach erosion control project on the Illinois shore of Lake Michigan are underway. Four navigation projects, eight flood control projects, and the shore protection project on Lake Michigan at Evanston are active authorized projects. Other authorized projects include four navigation projects and fifteen flood control projects. Navigation projects projects include four navigation projects and fif-teen flood control projects. Navigation projects under special continuing authorities include three small navigation projects, five small flood control projects, a discussion of emergency repairs and rescue, and a list of snagging and clearing projects and their costs. Flood plain information studies in-clude descriptions of two completed studies, one on the Des Plaines River, the other on the Little Calumet and tributaries, and a description of one study underway on the North Chicago Branch River. Survey investigations underway include the locality, purpose, and status of investigations on locality, purpose, and status of investigations on navigation, flood control, comprehensive basin stu-dies, and special studies on the navigation season and water levels of the Great Lakes. (Gossen-Chicago) W69-03591

SAN FRANCISCO BAY PLAN. San Francisco Bay Conservation and Development Commission, Calif.

San Francisco Bay Conservation and Development Commission, January 1969, 41 p, 19 map, 13 fig, 8 photo, I append.

Descriptors: Wildlife conservation, Landfills, ; *Water quality, *Administrative agencies, *Project to planning, Recreation, Fishing, Water sports, Inlets, ; *Public benefits, *Cost sharing.

Identifiers: San Francisco Bay.

This is a regional plan based on the recognition of the Bay as a single body of water and that changes in one part may affect other parts. Regarding the Bay as the most valuable natural asset of the region, the plan attempts to safeguard this asset for future generations and to maintain it for the highest public good. Indiscriminate bay filling is restricted to uses which will provide public benefits that could not be obtained without filling. These public benefits are:

(1) adequate port terminals; (2) land for industry that require access to shipping changels: (3) (1) adequate port terminals; (2) land for industry that require access to shipping channels; (3) recreational opportunities; (4) airport terminals and runways; (4) freeway route - if no feasible alternatives are available; and (5) developing public access to the Bay. The plan further proposes maintaining prime wildlife refuges and diked-off areas around the Bay and adding to the existing refuge system. The cost of the plan will be financed by private investment, some by joint private-public efforts and some will depend on public funds. The administrative funds necessary to keep the plan current and to help implement it is estimated at 400 to 500,000 per year. A major recommendation of the plan is the creation by the State legislature of a governmental agency to carry out the plan. (Starrgovernmental agency to carry out the plan. (Starr-Chicago)
W69-03592

WATERSHED, FLOOD PROTECTION, AND RECREATION DEVELOPMENT IN ATCHISON, KANSAS.

League of Women Voters Education Fund, Omaha, Nebr.

A. J. Mangelsdorf. League of Women Voters Education Fund, Lower Missouri River Basin Seminar, Land and Water for Tomorrow, Omaha, Nebraska, 1967. 9 pp.

Descriptors: Decision-making, *Project planning, *Watershed management, Flood damage, Flood protection, *Area redevelopment, Recreation facilities, Financing, Financial feasibility. Identifiers: Atchison (Kansas), Central Business

The city of Atchison, like most older communities, was plagued with a deteriorating central business district. Because of the inability to agree on a common program to mitigate the problem, nothing was done to renew the downtown area. In July, 1958, Atchison, located in the White Clay, Brewery Creeks Watershed, was flooded twice with total damages exceeding four million dollars, the city faced, not merely the decay of its downtown area, but the actual rebuilding of its commercial district and the development of a program to protect against future ravages by flood. President Eisenhower declared Atchison a disaster area. By doing so, he opened the door for a joint urban renewal project in the hard-hit downtown area and a flood control program. This was the first urban renewal project in the United States to deal with a commercial area. Financing, feasability, recreational benefits, and the citizens' planning of the projects are discussed. Volunteers petitioned for creation of a Watershed District. A retired army officer, Brigadier General A. D. Warnock, was particularly effective in petitioning, chairing the Watershed Board, and acting as the city's contracting officer. (Gossen-Chicago) W69-03593 The city of Atchison, like most older communities,

SOCIOLOGICAL FACTORS IN WATERSHED

DEVELOPMENT,
Mississippi State Univ., State College. Water
Resources Research Inst.
Kenneth Wilkinson, and Lucy W. Cole.
Water Resources Research Institute, Mississippi
State University, July 1967, 48 p, 113 ref.

Descriptors: Watershed management, Social adjustment, Water resources development, River

basin development, Mississippi watersheds, Research and development, Project planning, Multi-purpose projects, Watershed protection and flood prevention act.

Identifiers: Community responses, Voluntary or-

The report is the second phase of a research program to assess the influence of community structure on the effectiveness of local watershed development. The research deals with the sociological aspects of watershed development at a community level. Objectives of the research are as follows: to present a strategy and frame of reference for interaction between sociologists and water management professionals; to review sociological literature in water resources; and to present methodology and findings of empirical work. Approaches toward and findings of empirical work. Approaches to that a research interpretation process are presented. The interactional or field-theory approach is used in the research reported. The theory is a development of the research reported and approaches change. mental model of action which emphasizes change. Sociological and related studies of water resources are critically reviewed and related to the frame of reference - strategy and approach - of the research. Studies described are in water resources development planning, river basin studies, and small watersheds. A final section describes information collected on small watersheds in Mississippi. (Abodeely-Chicago) W69-03594

GEORGETOWN WATERFRONT.

Georgetown Planning Council, Washington, D. C.

Georgetown Planning Council, 1640 Wisconsin Ave., N. W., Washington, D. C., 1965, 12 p, 5 fig, 4 photo, 1 append.

Descriptors: *Highway relocation, *Scenic easements, Project planning, Underground structures, National historic parks, Zoning-industries. Identifiers: *Waterfront development.

The report, prepared for Secretary of the Interior Udall, gives the history of Georgetown, relates the present deterioration of its waterfront and defines the present deterioration of its waterront and defines the present opportunity to reclaim the waterfront for its historic and scenic value. Two recommenda-tions of the National Planning Commission en-courage present action: (1) that industry be removed from the waterfront, and (2) that the D. C. Highway Department design a new facility for the increasing traffic. The report illustrates present zoning regulations. It discusses the existing elevated freeway, and gives the economic advantages of a river tunnel. It discusses the human advantages of a designed community, and con-cludes with four recommendations: (1) that the area of Georgetown which represents the old seaport be designated a national historic site, (2) that the Potomac Freeway be located in a tunnel, (3) that the scenic easement process be used to control future development within this historic site, and (4) that the Secretary of the Interior use the scenic easement power to prevent development which does not conform to the above until the governmental process begins. The council later appended a list of objectives for the Georgetown study area, a comparison of highway solutions, a chart of tentative land use, and a summation of the alternatives and their implications. (Gossen-Chicago) W69-03595

COMPREHENSIVE RIVER BASIN PLANNING: THE ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE EXPERIENCE, Michigan Univ., Ann Arbor. Inst. of Public Ad-

ministration.
Robert H. Pealy.
Institute of Public Administration, University of Michigan, Ann Arbor, 1959, 71 p, 21 ref.

Descriptors: *Inter-agency cooperation, Federal government, Planning, Methodology, *Legislation, Scheduling, Arkansas, River Basin development.

The report evaluates the work of the Arkansas-White-Red Basins Inter-Agency Committee, which was created to devise a long-range 'comprehensive' plan for the development of water and related land resources of the AWR basins. The real importance of the AWRBIAC is not the plan itself but its possible use as a guide to future basin planning.

Described is the problem of coordinating different federal agencies represented in the committee, the inability to define the work 'comprehensive', the committee's legislative history, its organization and procedure, its financing and cost, its restriction by a rule of unanimous agreement, and its restriction by law from reexamining existing projects. Two specific controversies are related to illustrate the inner strife of the committee. The difficulty of agreeing upon a completion schedule is discussed. The final conception of the plan and its justification is stated. The uneasiness of the Bureau of the Budget over the committee's difficulties and its consequent intervention is discussed. This, together with the President's intervention, gave the committee impetus to bring their study to an end. Two recommendations are made for future committees: (1) that a chairman have final authority to make decisions, and (2) that such a committee not be restricted by proviso clauses; the unanimity rule is still under discussion. (Gossen-Chicago)

NARRAGANSETT BAY: A MARINE USE

PROFILE,
Lewis M. Alexander.
Office of Naval Research. Contract No. Nonr-396 (09), NR-389-134, June, 1966.

Descriptors: *Commercial shellfish, *Commercial fish, *Estuarine fisheries, *Rhode Island, *Competins, Estuarine Insieries, Rhode Island, Competing uses, Marine fisheries, Sport fishing, Fisheries, Shellfish, Aquatic life, Invertebrates, Animals, Aquatic animals, Wildlife, Fish, Water pollution, Hurricanes, Regions, Northeast U. S., New England, Geographical regions, Aquatic productivity, Productivity, Exploitation, Silting, Sedimentation, Efficiencies, Water utilization.

A portion of this report deals with the commercial fish and shellfish industries of Narragansett Bay, Rhode Island. Trends in values of commercially exploitable resources are discussed. Some of the factors seen limiting the industries or causing declines in fisheries production are pollution, hurricanes, silting, and over-exploitation of the resource. Conflicts between users of the resources are discussed, and the need for more studies of management problems is mentioned. W69-03606

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON CIVIL WORKS AC-TIVITIES.

Report, Corps of Engineers, Department of the Army, 1966.

Descriptors: *Harbors, *Rivers, *Water resources

*Enderal government, *Planning, Descriptors: *Harbors, *Rivers, *Water resources development, *Federal government, *Planning, *Federal budgets, *Data collections, Forecasting, Governments, Animals, Navigation, Beach erosion, Hydroelectric power, Recreation, Wildlife, Channel improvement, Electric power, Resource development, Administration, Flood control, Control, Water control, Bodies of water, Running streams, Surface waters, Erosion, Future planning (Projected), Long-term planning, Project planning, Short-term planning.

The civil work activities of the Department of the Army, as carried out by the Corps of Engineers during fiscal year 1965, are reported. Volume 1 reviews overall program status, accomplishments, and planning to meet existing and future needs and and planning to meet existing and ruture needs and presents summary data on water resource development by the Corps. Volume 2 contains detailed information on individual projects and activities by ports and harbors. During fiscal year 1965, expenditures were \$1,198.5 million on the civil works program. Of this amount, \$1,167 million was spent for rivers and harbors and flood control. W69-03608

ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL, For primary bibliographic entry see Field 05G.

For abstract, see . W69-03613

BOATING FACILITIES.

Outdoor Boating Club of America, Chicago, Illinois, Vols 1-8, 1959-1967.

Descriptors: *Recreation facilities, *Boating, *Marinas, *Boat-launching ramps, *Profit, *Prices, Recreation, Water sports, Water pollution, Recreation, Water sports, Statistics, Data collections.

The Outdoor Boating Club of America compiles information and reprints on boating and related facilities in periodic publications. Eight volumes, spanning the period 1959-1967, have been published to date. The reprints contain information on the economics of building and operating marinas. Other topics include: pollution and the marina, launching-ramp construction, marina profits, marina prices, profits of dry-land marinas, the marina and the community--feasibility and benefits, marina management, boating facilities found at marinas, 'From marsh to marina', 'A marina is good for a city', and 'Do marinas pay their wen'. their way'. W69-03615

ESTUARIES: A NEGLECTED RESOURCE COMPLEX, S. A. Cain.

Commercial Fisheries Review, Vol 28, No 10, October, 1966, pp 27-34.

Descriptors: *Monetary benefits, *Commercial fishing, *Fish harvest, Direct benefits, Sport fishing, Management, Coastal marshes, Salt marshes, Benefits, Income, Return (Monetary), Value, Commercial fish, Fishing, Industries, Recreation, Water sports, Bodies of water, Surface waters, Marshes, Wetlands, Coasts, Massachusetts, Geo-graphical regions, New England, Northeast U. S., Regions, Atlantic Ocean, Oceans, Pacific Ocean, Gulf of Mexico, Gulfs.

This article discusses some of the values and current problems associated with estuaries. The author states that: (1) A salt marsh in Massachusetts can yield \$300/year of seafood. (2) North Atlantic coast commercial finfish landings averaged 1.6 billion pounds in a recent 10-year period; shellfish non pounds in a recent 10-year period; shellish contributed about 107 million pounds, with a monetary value of \$90 million. (3) In a typical year, seafood landings produced 2.2 billion pounds on the Atlantic coast; Gulf coast, 1.4 billion pounds; Pacific coast (Hawaii excluded), 1.1 billions of the Atlantic Coast (Ha lion pounds. The total worth was \$362 million. (4) In 1960, three million fishermen spent more than \$1/3 billion on sport fishing on the Atlantic coast. W69-03620

COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF ESTUARIES, Henry P. Caulfield, Jr. A Symposium on Estuarine Fisheries, American Fisheries Society, Special Publication No 3, 1966,

Descriptors: *Management, *Planning, *Future planning (Projected), *Long-term planning, *Administration, Economic justification, Project planning, Decision making, Methodology, Feasibility, Productivity, Economic efficiency.

The use and management of estuaries involve some unique physical and analytical problems not normally encountered by water planners traditionally concerned with river basins. Nevertheless, the basic analytical framework which has evolved over time in seeking solutions to river basin problems is equally applicable to estuarine problems. This framework requires an understanding of (1) fundamental objectives of planning, development, and

Group 6B-Evaluation Process

management; (2) standards and criteria for translating these objectives into specific plans for improvement measures; and (3) processes and techniques of analysis in plan formulation to achieve stated objectives. Developing computational techniques enables persons to apply stan-dards and criteria to an expanded array of alternative solutions and to a greater choice of selected objectives. The opportunity to achieve optimal solutions is thereby enhanced. W69-03624

THE TEXAS BASINS PROJECT.

Charles R. Chapman.

A Symposium on Estuarine Fisheries, American Fisheries Society, Special Publication No 3, 1966, pp 83-92.

Descriptors: *Texas, *Commercial fishing, *Sport fishing, *Project planning, *Human population, *Water requirements, Tributaries, Bodies of water, Canal construction, Project feasibility, Planning, Feasibility, Running water, Streams, Coastal marshes, Fishing, Industries, Recreation, Water sports. Estuarine environment, Estuarine fisheries, Central U. S., Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southwest U. S., Marshes, Wetlands, Population, Fisheries, Fish har-

The proposed Texas-Basin-Project is a multiphased plan to establish 18 reservoirs to supply fresh water to a trans-Texas canal intercepting tributary discharges to all of the coastal marshes of the state. The project's area of influence, development plan, stages of construction, and operation are discussed. A general description is given of the Texas coastal fisheries. To date, the take of commercial species has been only partially exploited; and, although the trend is upwards, the overall harvest may more than double over the next three or four decades provided suitable environmental conditions in the estuary can be maintained. Estimates and projections of population, water requirements, etc., are presented for the years 1960 and 2010. By 2010 the Texas estuaries may be called upon to provide about 17-million man-days of angling as compared to the present seven million man-days of sport-fishing for estuarine species. W69-03625

CHESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL, NAVIGATION, EROSION, FISHERIES-MINUTES OF THE FIRST MEET-

ING.
Corps of Engineers, Department of the Army, Baltimore, Maryland, April 18, 1968.

Descriptors: *Maryland, *Flood control, *Naviga-Descriptors: "Maryland, "Flood Control, "Navga-tion, "Erosion, "Fisheries, Federal government, Governments, Appalachian Mountain region, At-lantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Control.

The primary discussion topics of the meeting reported were as follows: (1) Authorization and objectives of the Chesapeake Bay Study; (2) Studies that could be made with the use of a hydraulic model of the Chesapeake Bay; (3) Conversion of model data to prototype requirements; (4) Organization of task groups; (5) Outline of report to be submitted by the Corps to the Committee on Multiple Use of the Coastal Zone.

W69-03626

ECONOMICS OF OUTDOOR RECREATION, Marion Clawson, and Jack L. Knetsch. Johns Hopkins Press, Baltimore, Maryland, 1966.

Descriptors: *Economic impact, *Recreation demand, *Resource allocation, *Water resources, Recreation, Recreation facilities, Social aspects, Natural resources, Land use, Demand, Supply, Resources, Costs, Benefits, Values.

This book is the most comprehensive coverage available on the economics of outdoor recreation. It includes references to most of the other major papers and reports on the subject. Demand and supply aspects of outdoor recreation are given coverage in depth. Discussion on demand includes the construction of demand curves and factors which are important in estimating demand. Alterwhich are important in estimating demand. Alternatives to demand curves are also discussed. Recreation supply is analyzed from the perspectives of resource use, recreation quality, and description of existing areas. Economic considerations in outdoor recreation include: the value of land and water resources when used for recreation; economic impacts on local areas; costs and investment considerations; and pricing and paying for outdoor recreation facilities. Future aspects include policy issues and research. W69-03628

OYSTER-BASED ECONOMY OF FRANKLIN COUNTY, FLORIDA, M. Colberg, and D. M. Windham.

Report, Department of Health, Education and Welfare, Washington, D. C., 1966.

Descriptors: *Florida, *Oysters, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Commercial shellfish, Invertebrates, Marine animals, Mollusks, Shellfish, Employment opportunities, Human resources, Industries, Management, hiues, riuman resources, industries, Management, Fish management, Industrial production, Benefits, Labor, Economic impact, Atlantic coastal plain, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S.

This is a study of the importance of the oyster industry, economically and socially, to the residents of Franklin County, Florida. A general description of the county and the operation of the oyster industry in the county is provided. Graphs and tables on the income of a variety of sources to the county, as well as information on per capita income, are given. Comparisons with income from the oyster industry are made. Values added to oysters at various stages of production and distribution are discussed.
W69-03631

THE CONDITION OF THE CHESAPEAKE BAY.

Eugene Cronin.

Resources Conference, San Francisco, California, Transactions, March 13-15, 1967, pp 137-150.

Descriptors: *Maryland, *Water values, *Transportation, *Recreation, *Bays, *Aquatic productivity, *Sanitary engineering, *Statistics, *Waste disposal, Erosion, Appalachian Mountain region, Alantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Social values, Water utilization, Water resources, Navigable waters, Commercial fishing, Fishing, Bodies of water, Productivity, Efficiencies, Engineering, Resources, Effluents, Animal ecology, Plant ecology, Fishing, Data collections, Values, Ecology.

The author reviews the principal uses of the Chesapeake Bay and their outlook for the future: (1) Transportation - In 1964, 107,253,730 tons were handled by Baltimore and Norfolk. Baltimore alone receives approximately 5,000 ocean-going ships per year. Other uses are affected through transportation uses of the Bay, mainly through pollution by bilge pumping, overboard spillage, and channel deepening and maintenance. (2) Biotic Yield - Oyster production has been decimated by excessive exploitation and other species have been reduced Oyster production has been decimated by excessive exploitation and other species have been reduced by tributary dams and pollution, but changes in gear have vastly increased the catch of menhaden soft shell clams and crabs. (3) Recreation and Esthetics. (4) Waste Disposal - The Baltimore-Washington area expects its population to double from 1960 to 1985. There are three alternatives to the problem of waste disposal given in the paper. (5) The author cites other changes in the Bay which are potentially damaging to the area: (a) Destruction and conversion of marshland; (b) Diversion and damming of tributaries; (c) Invasion of water plant and animal life; (d) Land and shore ension. W69-03637

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF THE LISSELMEER. Dienst Der Zuiderzeewerken, The Hague, Netherlands, No 37, November, 1967.

Descriptors: *Land reclamation, *Benefits, *Foreign countries, Coastal engineering, Drainage, Engineering, Geographical regions, Regions.

This bulletin describes how the enclosure of the Zuiderzee and the reclamations in the LJsselmeer Zuiderzee and the reclamations in the Dissellner were carried out. Benefits derived from this project are listed, and the progress reports of the individual polders are given. A set of maps illustrates operations in various stages of completion. W69-03657

THE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,

J. B. Engle. National Shellfish Association, Proceedings, No 56, May, 1966, pp 13-21.

Descriptors: *Commercial shellfish, *Clams, *Oysters, *Aquatic productivity, *Economic impact, Mollusks, Fish management, Productivity, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Invertebrates, Shellfish, Marine animals, Water pollution, Water control, Control, Predation, Animal parasites, Bays, Bodies of water, Gulf of Mexico, Gulfs, Surface waters.

Comparative information is provided on the internal status of commercial shellfisheries in the United States. The oyster resource has not been adequately managed in the Chesapeake Bay, the area of greatest potential production, accounting for 50% of the total U. S. oyster production in this century. of the total U. S. oyster production in this century. Chesapeake Bay oyster production today is only 10% of that in 1900. Production, while declining in the Chesapeake region, and even more so in the Middle Atlantic and New England regions, has increased considerably in the Gulf of Mexico and Pacific regions. At certain regions, and during certain periods, poor management, or no management at all, has contributed to the decline. In addition, such elements as (1) pollution due to propulation such elements as (1) pollution due to population such elements as (1) pollution due to population increase and lagging sanitation improvements, (2) the 'so-called improvements' of waterfronts for navigational, industrial, and domestic purposes, and the control of headwater impoundments for power, flood-control and increased water requirements, and (3) the difficulties of controlling parasites and predators have contributed to the decline of production. One other significant factor is the sales competition from more conveniently packaged and usable foods. The increase in packaged and usable foods. The increase in production in the Gulf States has been stimulated production in the Gulf States has been stimulated by a drop in production in the northern areas, particularly the Chesapeake Bay. Clam production, including razor, soft shell and hard clams has increased somewhat. Of the estuarine species, the hard clam is important economically to the Middle Atlantic and New England area primarily. Many who formerly depended on oysters have converted to hard clamming as a significant adjunct to their business. Soft-shell clam production has increased, largely due to the hydraulic dredge recently developed in Maryland. Clamming is relatively unimportant on the West Coast as far as total U. S. production.

ESTUARIES: IRREPLACEABLE ENVIRON-MENTS.

Gulf Review, Vol 2, No 1, September, 1967, pp 1-

Descriptors: *Economic impact, *Gulf of Mexico, *Reviews, Water resources development, Bodies of water, Gulfs, Surface waters.

The article emphasizes the economic importance of estuaries and lists several current comprehensive studies on estuaries and estuarine zones. W69-03662

GOVERNMENT, INDUSTRY AND SCIENCE STUDY POTENTIAL OF SEAWEEDS. Fisheries of Canada, Vol 19, No 11, May, 1967, pp

Descriptors: *Marine plants, *Aquatic productivity, *Value, Marine fisheries, Submerged plants, Plants, Aquatic plants, Aquatic life, Productivity, Water utilization, Fisheries, Efficiencies, Geographical regions, Regions, Atlantic Ocean, Bodies of water, Oceans, Surface waters.

At the present time, seaweeds along Canada's Atlantic coast are worth about \$1 million per year. It is stated that the resource is under-utilized and has valuable possibilities as a cash crop. W69-03672

GULF OF MEXICO IS STILL BOOMING. Offshore, Vol 27, No 7, June 20, 1967, pp 60-69.

Descriptors: *Oil industry, *Oil reservoirs, *Oil wells, *Gulf of Mexico, *Data collections, Resources, Drilling, Natural gas, Oil, Wells, Drill holes, Louisiana, Texas, Florida, Industries, Exploitation, Gases, Organic compounds, Natural resources, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S., Gulfs, Bodies of water, Surface waters, Oil field.

The offshore oil potential of the Gulf of Mexico is examined, and drilling forecasts and completions are tabulated. Louisiana reserves are compared to total United States reserves, and sizes of production wells are discussed.

ECONOMIC ASPECTS OF THE DELAWARE RIVER ESTUARY PROGRAM,

William B. Halladay.

Paper presented to the American Association of Cost Engineers, 1967 Annual Convention, Cleveland, Ohio, July 10-12, 1967.

Descriptors: *Cost-benefit analysis, *Delaware river basin commission, *Delaware river, Water quality, Legislation, Management, Interstate commissions, River basin commissions, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters, Political aspects, Economics.

The author brings out the various cost-benefit relations involved in the Delaware River Estuary. He mentions the problem of emotion and politics often overshadowing need and economic fact in water quality legislation.

W69-03674

CONSERVATION AND MANAGEMENT OF SEASHORE AND UNDERWATER AREAS FOR PUBLIC ENJOYMENT, George B. Hartzog, Jr. Latin American Conference on Conservation of

Renewable Natural Resources, International Union for the Conservation of Nature and Natural Resources, San Carlos de Bariloche, Rio Negro, Argentina, No 3361-368, March 27-April 2, 1968.

Descriptors: *Recreation facilities, *Underwater, *Seashores, *Land use, *National seashores, Natural resources, Ecology, Management, Coastal engineering, Engineering, Water pollution, Parks, Coasts, Shores, Resources.

The acreage of seacoast available for public enjoyment is rapidly decreasing, due to three major factors: (1) Real estate speculation and private ownership of ocean front property; (2) Water pollution; (3) Coastal engineering (draining, dredging, filling, dam building). What land is left for public recrea-

tion should be scrupulously managed to maintain the ecological balance, as well as protect the interests of the seaside vacationer. Underwater parks are a recent development which can expand the recreational (and educational) use of a seaside park. W69-03676

INDEX OF SELECTED OUTDOOR RECREATION LITERATURE, VOLUME II. Bureau of Outdoor Recreation, Washington, D. C.

Report No 7000-70847, March, 1968.

Descriptors: *Abstracts, *Recreation, Documentation, Bibliographies.

This is a compilation of abstracts of articles, books, conference proceedings, directories, documents, reports, speeches, yearbooks, and bibliographies of outdoor recreation literature. W69-03681

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS: A SELECTED ANNOTATED BIBLIOGRAPHY.

Tennessee Valley Authority, Knoxville, Tennessee, October, 1967.

Descriptors: *Cost-benefit analysis, *Water resources development, *Bibliographies, *Water pollution control, Abstracts, Documentation, Control, Navigation, Flood control, Water control, Recreation, Appreciation, Real property, Property values, Value, Forecasting, Evaluation.

The bibliography is divided into six major subject categories: (1) Basic works; (2) Flood control; (3) Navigation; (4) Pollution (quality) control; (5) Recreation; (6) Land value enhancement. Within each subject category the abstracts are placed under the following headings: (1) Definition; (2) Forecasting demand; (3) Benefit measurement and/or cost determination; (4) Evaluation techniques; (5) Decision criteria.

W69-03691

WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,

Engineering Progress, Vol XXI, No 6, June, 1967,

Descriptors: *Water policy, *Water quality, *Costs, *Industrial water, *Indirect benefits, In-stitutional constraints, Water pollution effects, Economic efficiency, Benefits, Social aspects, So-cial values, Values, Water types, Constraints, Cost analysis, Analysis, Mathematical studies, Cost comparisons, Economic impact, Recreation.

The author maintains that 'economics' is often defined only in narrow terms relating to financial returns. In water resource terms the results are often the assumption that certain benefits fall in the social realm, but are not economic in nature. The author maintains that it is often possible to impute economic values to so-called social benefits and thus evaluate them rigorously. A review of economic studies on water quality leads the author to the following conclusions: (1) Industrial costs relating to water intake are surprisingly insensitive to the quality of intake water, (2) Poor water intake quality does result in extra costs for municipal use, but these costs are usually small in relation to the cost of upstream treatment, (3) Some evidence exists that reasonable values assigned to recreational use would justify increased treatment, at least in one area studied, (4) Too much emphasis is being placed on physical considerations in water quality management and not enough on economics. The problems of institutional arrangements needed to implant optimum standards are also discussed. W69-03697

6C. Cost Allocation. Cost Sharing, Pricing/Repayment

REGULATION OF WITHDRAWALS AND DIVERSIONS.

N Y Conserv Law sec 801, Art 10 secs 10.1, 10.2, 10.3, 10.4, 10.5 (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, Conservation, Water resources, Planning, Water resources development, *Water policy, Administration, Droughts, *Withdrawals, Diversion, *Water shortage, River basin commissions, Surface waters, Legal aspects, Permits.

The commission may regulate and control withdrawals and diversions from surface and ground waters of the basin, and such power may be delegated. It may, after proper notice and public hearing, delineate areas where a water shortage has developed or is threatened so as to impair or con-flict with the comprehensive plan; any such area may be designated a 'protected area.' This status may be terminated at the discretion of the commission. No one may divert or withdraw water from such protected areas except pursuant to a permit granted by the commission or any signatory state. In the event of a drought or other condition that causes or may cause an actual, immediate shortage of water in any part of the basin, the commission may designate the affected area and declare an emergency; in such a case, no water shall be withdrawn or diverted without the approval of the commission. Permits may be granted or denied so as to avoid such depletion in the protected or emergency. gency area as will adversely affect the comprehensive plan or the equitable interests of other lawful users. (Scott-Fla) W69-03303

A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES, Rice (Cyrus W.) and Co., Pittsburgh, Pa. Henry C. Bramer, and Donald J. Motz. Report, Apr 18, 1968. 159 p., 2 fig, 14 tab, 16 ref, 2 append. 14-01-001-1581 (OWRR).

Descriptors: *Systems analysis, *Water costs, *Industrial water, Municipal water, Water reuse, Management, Model studies.

Identifiers: Industrial water costs, Systems approach.

A method developed through the systems approach, by which industrial water costs can be determined in a consistent, reliable manner for systems of any size and composition, is presented. The systems parameters are defined for use in a model which may easily be used in computers. The proper measure of costs is the generally accepted manufacturing cost of a goods produced for sale. Relative costs of industrial water within and between several industries are shown and analyzed. Data from 22 industrial plants in the steel, petrole-Data from 22 industrial plants in the steel, petrole-um, paper, and electric power industries were acquired on forms designed for use by experienced engineers. Checks for consistency, reliability, and accuracy were run. Flow diagrams show patterns of water use and reuse. Direct costs include purchased water, treatment chemicals, labor, and power. Other costs include taxes, overhead, depreciation, amortization, interest, and dividends. Direct costs are the greatest part of the total cost of low-cost water, but are very little of the cost of expensive water. Municipal water costs are similar to the overall industry average. (Knapp-USGS) W69-03322

CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (TAX ASSESSMENT OF WATER RESERVE LANDS).

103 N J Super 109, 246 A 2d 722-728 (1968).

Group 6C-Cost Allocation, Cost Sharing, Pricing/Repayment

Descriptors: *New Jersey, Judicial decisions, *Assessments, Taxes, Water supply, *Legislation, Property values, Land appraisal, *Small watersheds, Legal aspects, Cities, Administrative agencies, Water resources, Evaluation, Real property.

The City of East Orange owned lands, located in the township of Livingston, which comprised por-tions of the East Orange Water Reserve. An expert tions of the East Orange Water Reserve. An expert valued these undeveloped water reserve lands for tax purposes. In so doing, he disregarded increased prices at which comparable properties were selling because city property was not on the market and could not enjoy increase in value. Livingston appealed from the judgment of the Division of Tax Appeals reducing the assessment from prior years. The appellate court reversed, and fixed a higher assessment. The court ruled that a statute did apply which stated that public water supply lands are taxable in the taxing district where located, without regard to any buildings or improvements thereon, in the same manner and to the same extent as the lands of private persons. The court ruled that the expert's valuation method for the lands was erroneous, and in violation of legislative mandate. As a matter of public interest, the court went on to fix a final assessment for the year in question. The final assessment took into consideration rising prices of other property in the area from sales for all permitted uses. (Wheeler-Fla)
W69-03442

ANDREWS V STATE (CONDEMNATION VALUE OF REALTY), 188 NYS 2d 854-865 (Ct C1 1959).

Descriptors: *New York, *St. Lawrence River, *Appropriation, *Value, Legal aspects, Judicial decisions, Navigable waters, Riparian rights, Hydro-electric power, Resource development, Damages, River flow, Bridge construction, Eminent domain, State governments, Interest, Evaluation Evaluation.

Identifiers: Fair market value.

This was an action to recover damages for the appropriation of real property for the improvement of the St. Lawrence River. The major problem before the court was the determination of the fair market value of the land appropriated. The state contended that the value of the land was merely that of like agricultural land. The Court of Claims, howlike agricultural land. The Court of Claims, how-ever, held that when a special aspect of the land, such as suitability for hydro-electric development, is neither conjectural nor speculative, that aspect must be considered in fixing the fair market value. The court also considered frontage on a navigable stream and ordinary reparian rights valued for their highest and best use in determining fair market value. The court concluded that a buyer would have contemplated use of the property for industrihave contemplated use of the property for industrial and commercial purposes, including the development of the hydro-electric power of the St. Lawrence Seaway, and awarded damages and interest to the plaintiff. (Sisserson-Fla) W69-03450

GRANTING REVOCABLE PERMITS.

N Y Canal Law secs 100 (McKinney Supp 1968), 1

Descriptors: *New York, Legislation, Permits, *Canal structures, *Navigation, Transportation, Industrial use, Ice, Diversion, Banks, Industrial use (Water), Administrative agencies, State governments, Legal aspects.

The commissioner of transportation may issue revocable permits granting certain limited privileges if it can be done without detriment to canal navigation or damage to the banks. He shall determine the terms of such permits which may be issued for the temporary use of canal lands or structures and for the diversion of canal waters for sanitary farm supposes, or industrial use the may also tary, farm purposes, or industrial use. He may also issue permits to any person to cut, gather and haul away ice from the canals. Permits may be issued for

the temporary use or occupation of canal terminals for the purpose of handling, storing or transferring freight in or for transit. All permits issued prior to the enactment of this statute and not cancelled are legalized and given the same effect as if the statue were in force on the day the permit was issued. No liability of any kind shall attach to or rest upon the state for any damage on account of the granting or revocation of any permits. (Shevin-Fla)

DISTRIBUTION OF COSTS OF MULTIPLE-PURPOSE HYDRAULIC PROJECTS. Alberto Luis Grandi.

For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, 1968. pp 739-745, 7 p, 1

Descriptors: *Cost allocation, Costs, *Multiple purpose projects, Benefits, Specific costs. Identifiers: Common costs, Marketability theory, Benefit theory, Installation use theory, Specific cost theory.

The task of allocating a cost to each use, function or benefit pertaining to a multiple-purpose hydraulic project is extremely complex. The major porblem consists in establishing an equitable distribution of the common costs of the installations shared by all users. The author reviews all the criteria which he has differentiated and concludes by stating that it should be considered axiomatic that the cost of any specific service provided by a multiple-purpose project should be less than the cost that would be entailed if separate installations were constructed. The author also cites foreign and national examples of the allocation of costs for this type of project. W69-03577

THE BOATING BUSINESS (1966).

Boating Industry, Chicago, Illinois, 1966.

Descriptors: *Boating, *Statistics, Recreation, Marinas, Data collections, Water sports, Recreation facilities, Accidents, Expenditures, Foreign

This is a yearly trade publication which presents statistics on the pleasure boating industry. The subjects covered include: use of recreation boats; sales of boats, motors, and equipment; retail expenditures; distribution of boats and motors by state; buyer characteristics; dealer characteristics; marinas; accidents; and foreign trade. W69-03614

FISHING FLEET TRIES TO CAST OFF THE

Business Week, October 21, 1967, pp 94-98.

Descriptors: *Commercial fishing, *Competition, *Government supports, Competitive prices, Fishing, Fisheries, Water utilization, Efficiencies, Prices, Import, Foreign trade, International commissions, Marketing.

The author summarizes discussion held at a recent Commercial Fisheries Exposition. Foreign competition in fishing fleets sales and import of fish, and obsolescence in our own industry is leading to a decline in fisheries production in the U. S. Such things as government subsidization and international control are seen as the only hopes for the future. W69-03664

CALIFORNIA SALMON LANDINGS, 1952

THROUGH 1965, P. T. Jensen, and P. G. Scwartzell. Fishery Bulletin, Vol 135, 1967, pp 43-57.

Descriptors: *Salmon, *Market value, *Fish harvest, *California, Commercial fishing, Sport fish, vest, "Camornia, Commercial Issining, Sport fish, Fishing, Industries, Animals, Aquatic animals, Aquatic life, Fish, Wildlife, Sport fishing, Recreation, Water sports, Salmonids, Income, Return (Monetary), Value, Geographical regions, Pacific coast region, Regions, Southwest U. S.

Trends in landings and dollar values of salmon landed both commercially and by sport fishermen in California ports are provided for the years 1952-W69-03686

6D. Water Demand

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS: VOLUME I-DEVELOPMENT OF THE MAIN SYSTEM; VOLUME II-DESCRIPTION OF THE MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS. Hittman Associates, Inc., Columbia, Maryland

Order from the Clearinghouse as PB 182 555, Vol. 1, PB-182 556, Vol. 2, \$3.00 per volume in paper copy. \$0.65 per volume in microfiche. HTTTMAN Ass, Inc Rep No HIT-336, June 1968: Vol 1, 102 p, 18 fig, 12 tab, 92 ref, 4 append; Vol 2, 143 p, 53 fig, 4 append. OWRR: 14-01-001.

Descriptors: *Water management (Applied), *Water requirements, *Municipal water, *Computer models, *Computer programs, Digital computers, Forecasting, Statistics, Water utilization, Water demand.

Identifiers: *Municipal water requirement model.

A digital computer model for calculating, forecasting, and evaluating municipal water requirements is presented. The model is composed of a system of modular computer programs that calculate water usage for residential, commercial, industrial, and public-unaccounted segments of urban areas. The public-unaccounted segments of urban areas. The parameters include such items as: number of residences in each value range, population density, price of water, sewage disposal method, number of students, number of hospital beds, industrial population by type of industry, and geographic location of the urban area. A Library of Water Usage Parameters, on magnetic tape, contains usage coefficients, equation constants and listings of the ficients, equation constants, and listings of the precipitation and potential evapotranspiration data for the entire United States that are required to relate and calculate municipal water usage from the late and calculate municipal water usage from the various input parameters. Equations were derived using statistical techniques to relate water usage to the parameters with the greatest influence on usage. The MAIN I System was tested in Baltimore, Maryland and Park Forest, Illinois. In Baltimore, the calculated overall usage was about 77% greater than actual usage. In Park Forest, computed usage for four of the years was within 16% of actual usage and within 25% for the fifth year. The projection made for the last year was within 15% of the actual usage. A detailed explanation of the computer recommends. made for the last year was within 15% of the actual usage. A detailed explanation of the computer programs and the use of the System and the Library of Water Usage Parameters, with a flow chart documentation of all of the programs and the values in the Library, is included. For description of magnetic tapes associated with the report, see W69-03202. (Knapp-USGS)

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIRE-

Hittman Associates, Inc., Columbia, Maryland.

Order from the Clearinghouse as PB-182 557, \$150.00 2 reels. Hittman Associates, Inc. Magnetic Tapes: Tape One, Library of Water Usage Parameters; Tape Two, Source Language Programs, June, 1968. OWRR: 14-01-001.

Water Law and Institutions—Group 6E

Descriptors: *Water management (Applied), *Water requirements, *Municipal water, *Computer models, *Computer programs, Digital computers, Forecasting, Statistics, Water utilization, Water demand.

Identifiers: *Municipal water requirement model.

The first magnetic tape contains the Library of Water Usage Parameters which is a listing of the equation constants, coefficients, and environmental data used in making the calculations of water usage. The second magnetic tape contains the MAIN I Processor, which is the computer program that accepts the input data and inputs from the that accepts the input data and impute Library, performs the calculations and generates the water usage reports. The 'MAIN I System' can be run on an IBM 360 Model 40 or larger computer having a minimum memory size of 120,000 bytes (non-partitioned). It has also been run on a UNIVAC 1108 computer and with minor program modifications could be run on other computers comparable in size to the IBM 360 Model 40. In connection with the development of the system, it was found that about one man-month of effort was was found that about one man-month of effort was required to collect and prepare the input data. Actual running times for the system were about three minutes on the UNIVAC 1108 and eight minutes on a IBM 360 Model 50, per city. Explanation and documentation of the program are included in a two-volume report (W69-03201). W69-03202

WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,

Tennessee Dept. of Conservation, Nashville. Div. of Water Resources.

Alfred M. F. Johnson, John M. Wilson, and Harry Tenn Dep Conserv Div Water Resources Rep,

1968. 34 p, 11 fig, 4 tab, 8 ref, 2 append.

Descriptors: *Water utilization, *Tennessee, Irrigation, Stock water, Precipitation (Atmospheric), Legal aspects, Regulation, Riparian rights, Reasonable use.

Identifiers: *Tennessee water-use registration law, Water-use survey.

To implement the water-use registration law which was passed by the 1963 Tennessee General Assembly, the State Division of Water Resources undertook a water-use survey in 1964. A question-naire was distributed to all known water users and numerous personal contacts were made to check and verify the returns as well as to interview the water users who were exempt from registration. The survey of agricultural water users revealed that 11.4 billion gal of water was required for watering livestock, 3.1 billion gal was used for irrigation of crop and pastureland, and 30 million gal was used for washing vegetables. The total acreage of cultivated farmland in Tennessee appears to have decreased 9% between 1958, the date of the last water-use survey, and 1964. During the same period the total irrigated acreage appears to have decreased about 56%. The apparent sharp decline in irrigation is due chiefly to the abundance of rainfall in 1964 in comparison with 1958. The survey of agricultural water users revealed that fall in 1964 in comparison with 1958. W69-03323

THE ROLE OF INDUSTRIAL PROCESS CHANGES IN AFFECTING WATER REQUIRE-

MENTS,
Washington, State Univ., Pullman. Bureau of Economic and Business Research.

Completion Report, Washington Water Research Center, January 31, 1969. 23 p. OWRR Project A-013-WASH.

Descriptors: *Industrial water, *Water requirements, Washington, Pacific Northwest U. S., *Economics.

The potential for affecting water requirements by altering processes of industrial activities is examined. Industrial activities are defined broadly to

include agricultural, mining and utility activities as well as manufacturing. Attention is concentrated on industrial activities of particular importance to Washington and Pacific Northwest. Thermal electric generation is considered important because of its anticipated growth in the future. Process change is discussed in relationship to establishment and the firm. The nature of process changes that can be instituted are enumerated. In addition, process changes that are outside area of responsibility of the firm and establishment are indicated. Direct control and indirect incentives are cited as being the two basic approaches to developing an optimization scheme for water use. A basic conclusion is that process change can be an important influence of water use in the long-run may be the most important determinant of industrial water requirements. W69-03599

SUMMARY OF THE 1963 AND 1964 SOUTHERN CALIFORNIA INSHORE BAIT FISHERY.

K. D. Aasen.

California Fish and Game, Vol 53, No 1, 1967, pp 28-34.

Descriptors: *Commercial fishing, *Sport fishing, *California, *Bait fishing, *Statistics, Construction, Marinas, Geographical regions, Pacific coast region, Regions, Southwest U. S., Fishing, Industries, Recreation, Water sports, Harbors, Excavation, Recreation facilities, Military reservations, Federal reservations, Public lands, Data collec-

The distribution, method of catch, and the 1963 and 1964 catch statistics are given for the most commonly taken Southern California inshore bait species. The author states that the 180,000 pounds species. The author states that the 180,000 pounds per year (valued at \$90,000) is adequate to supply the needs of the sport fishermen at this time, however, many prime fishing areas are being lost due to construction of new harbors and marinas. Certain areas within the boundaries of military reservations, now closed to public access, might make alternative bait fishing sites. W69-03604

INDUSTRY OUTLOOK/DIRECTION 1968,

J. E. Kastrop, and J. Scott. Petroleum Engineer, Vol 40, No 1, January, 1968, pp 49-61.

Descriptors: *Oil industry, *Oil reservoirs, *Demand, *Costs, Secondary recovery (Oil), Flooding, Injection, Industries, Drilling, Natural gas, Gases, Organic compounds.

United States demand figures for oil and gas are related to known reserves. Drilling rig figures are tabulated showing types and numbers, depths and costs. Problems and location costs are discussed.

THE ECONOMICS OF RECREATION.

Norborne Berkeley, Jr. Parks and Recreation, July, 1966, pp 549-550.

Descriptors: *Recreation demand, *Social participation, *Economic prediction, *Statistics, *Value, Economic impact, Recreation facilities, Demand, Forecasting, Data collections, Surveys,

The author says that, due to automation and the shorter work week, the average American is finding himself with more free time than ever before. Our economy is geared to expanding this free time and expanding use of that free time for active recrea-tion. More than almost any other business field in the past twenty-five years, recreation has grown rapidly as a source of work and as an item in the budgets of most Americans. In 1964, there were approximately 35,000 full-time year-round workers in the specific field of recreation and about 100,000 part-time workers, plus millions whose jobs are indirectly dependent on recreation. And in that same year, Americans spent \$24,000,000,000 on recreation, and increase of more than 500 percent since 1950. Gallup polls have found that these leisure time activities have provided an expanding 'leisure market' which by the end of 1969 will amount to an estimated 50,000,000,000.

6E. Water Law and **Institutions**

DEPARTMENT OF NATURAL RESOURCES. Mass Ann Laws Ch 12, secs 9-16 (1967).

Descriptors: *Watershed protection and flood prevention act, *Legislation, *Administration, *Resources, *Massachusetts, Administrative agencies, Adoption of practices, Land resources, Water resources, Decision making, Conservation, Coordination, Legal aspects, Watershed management, Watersheds, Basins, Surface waters, Underground

A Commissioner of Natural Resources, appointed by the Board of Natural Resources, is the chairman of a commission in charge of matters concerning watersheds, water systems, storage basins, un-derground and surface water supplies, and studies related to the water conservation and flood prevention needs of the State. The Commission: (1) proposes legislation designed to provide the State with a basic water policy; (2) acts as a coordinating agency between all the departments of the State; (3) cooperates with the Fed Gov and agencies of other states in carrying out water conservation and flood prevention programs; and (4) has supervisory responsibility over programs provided for by the Watershed Protection and Flood Prevention Act (P L 566-83d Cong 2nd S). Applications for assistance under the Act must be initiated by local organizations and filed with the Commission. The Commission may assume a proportionate share of the non-federal cost of installing any works of improvement. No person may engage in the business of drilling or digging wells unless he is registered with the Commission. (Molica-Fla) W69-03255

DEPARTMENT OF NATURAL RESOURCES. Mass Ann Laws Ch 12, secs 17, 18, 19, 22, 23, 24, 25 (1967).

Descriptors: *Legislation, *Administration, *Massachusetts, Coordination, Administrative agencies, Adoption of practices, *Land resources, *Water resources, Decision making, Conservation, Legal

The Dept of Natural Resources consists of a Public Access Board funded to provide for public access and related facilities in and to great ponds, inland waters, and coastal waters. The Division of Conservation Services administers laws relating to conservation districts and has a Committee for Conserva-Committee establishes conservation districts, each composed of five supervisors who own or reside on land within the districts, to carry on the various duties and powers delegated to them. (Molica-Fla) W69-03256

DEPARTMENT OF NATURAL RESOURCES. Mass Ann Laws Ch 21, secs 1-2c (1967).

Descriptors: *Legislation, Planning, Administration, Coordination, Administrative agencies, Decision making, *Land resources, *Water resources, Conservation, *Massachusetts, Adoption of practices, Legal aspects.

The Department of Natural Resources exercises general care and authority over the natural resources and adjacent waters. Prior to the passage

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of this act the Dept of Conservation held that of this act the Dept of Conservation held that authority now vested in the Dept of Natural Resources. The Dept consists of the divisions of Forests and Parks, Marine Fisheries, Law Enforcement, Fisheries and Game, Water Resources, and Conservation Services. The Dept, with the exception of the Divisions of Fisheries and Game and Water Resources, is controlled by a board of five manufacts appointed by the government for terms of members appointed by the governor for terms of five years. The Board must meet at least once a month, and its members may be removed for cause. (Molica-Fla) W69-03257

POWER OF THE DEPARTMENT OF PUBLIC WORKS TO TAKE AND HOLD REAL ESTATE AND BUILD THEREON.

Mass Ann Laws, ch 91, sec 5 (1967).

*Legislation, *Massachusetts. *Eminent domain, *Administrative agencies, Easements, Condemnation, Piers, Highways, Channels, Railroads, Industrial plants, Docks.

With the consent of the governor and council, the Department of Public Works of the State of Massachusetts may take and hold by eminent domain, or acquire by purchase or otherwise, such real property and such rights and easements as the department may from time to time consider necessary for the purpose of constructing, or securing the construction or utilization of, piers; and in connection struction of unization of, piers, and in comiection therewith, highways, waterways, railroads connections, storage yards, and sites for warehouses and industrial establishments. It may lay out and build thereon, and upon other land in its jurisdiction, such facilities mentioned above. However, if general plans, approved by the department, show-ing the proposed location and character of the ing the proposed location and character of the facilities, are filed with the department by the owners or lessees of the property stating that they intend to build the proposed facilities, then the land will not be taken within 40 years after the date of filing the plans if substantial construction in acruing the plans it substantial construction in accordance with the plans is actually begun in good faith within one year after approved by the department. The construction must be substantially finished within 5 years unless the department extends the time. (Watson-Fla) W69-03260

DEVELOPMENT OF WATERFRONT FACILITIES - IMPROVEMENT AND PRESERVATION OF RIVERS, HARBORS, ETC. Mass Ann Laws, ch 91, sec 9A, 10, 11 (1967).

Descriptors: *Massachusetts, *Legislation, *Administrative agencies, *Public lands, Harbors, Piers, Financing, Eminent domain, Easements, Tidal waters, Connecticut, Rivers, Channels, Banks, Navigation, Encroachment, Surveys, Streams, Great ponds, Intertidal areas, Shores, Beaches, Bridges, Culverts, Conduits, Pipes, Dams.

The Department of Public Works of the Commonwealth of Massachusetts is empowered to adopt a program of construction or reconstruction of piers and other waterfront terminal facilities at any port of the commonwealth after holding proper hearings. The department may use the power of eminent domain to acquire the needed land for such facilities. It also has general care and supervision of the harbors and tide waters of the commonwealth, the flats and lands flowed thereby, the waters and banks of the Connecticut River, the banks and waters of the nontidal portion of the Merrimack River, and all of the structures therein to prevent and remove any encroachment which Merrimack River, and all of the structures therein to prevent and remove any encroachment which might harm the water or its navigation. The department shall also undertake such construction and work for the improvement, development, maintenance and protection of tidal and non-tidal rivers and streams, great ponds, harbors, tide waters, foreshores and shores along public beaches as it deems reasonable and proper. The department, in pursuance of the work authorized, may construct, reconstruct, alter, and repair bridges, culverts, conduits, pipes, walls, and dams, and may do such other incidental works as may be deemed necessary for the improvement and safety of waterways. Watson-Fla) W69-03261

STRUCTURES THE DEPARTMENT OF PUBLIC WORKS MAY LICENSE TO BE ERECTED IN RIVERS AND STREAMS.

Mass Ann Laws ch 91, secs 12, 12A (1967).

Descriptors: *Massachusetts, *Legislation, *Administrative agencies, *Permits, Dams, Roads, Bridges, Landfills, Pile driving, Construction, Excavation, High water mark, Connecticut, Rivers, Banks, Flood control, Streams, Channels, Cities, Federal government, Stream improvement.

The Department of Public Works of the Common-wealth of Massachusetts may license and prescribe the terms for the construction or extension of a dam, road, bridge, or other structure; or the filling of land, the driving of piles, or the making of ex-cavations, in, over or upon the waters below the high water mark of any river or stream within the commonwealth. This applies to rivers and streams with respect to which expenditures from federal, state or municipal funds have been made for stream clearance, channel improvement, or any form of flood control or prevention work. All structures constructed below the highwater mark of such rivers and streams described above without a license are deemed a public nuisance. The department has the power of license over structures identical to those listed above on the Connecticut River and designated portions of the Westfield River. (Watson-Fla) W69-03262

LICENSES IN CONN RIVER, GREAT PONDS, AND TIDE WATERS AS TO BOOMS, PIERS, WHARVES, PIPE LINE, ETC. Mass Ann Laws ch 91, secs 13, 14 (1967).

Descriptors: *Massachusetts, *Public lands, *Permits, Legislation, *Water law, Piers, Administrative agencies, Rivers, Great ponds, Tidal waters, High water mark, See walls, Dams, Bridges, Landfills, Riparian rights, Retaining walls, Docks, Connecticut, Pile driving, Excavation, Conduits. Identifiers: Booms

The Department of Public Works of the Commonwealth of Mass may license any person to construct mealth of Mass may license any person to construct and maintain booms in or across the Conn River, for periods of not more than 5 years, or to build and extend a wharf, pier, or shore wall below the high water mark of the river. It may also issue licenses to build or extend a wharf, pier, dam, wall, road, bridge or other structure, or to drive piles, fill land, or excavate in or over the waters of any great pond or tide water, below the high water mark, but not, except as specifically allowed by law, beyond any established harbor line. The department may also license and prescribe the terms for the construction or extension of a pipe line, conduit, or cable under tide water beyond any established harbor line, provided that such pipe line or conduit is entirely imbedded in the soil and does not occupy any part of the tide water; and the department may at any time require the removal or relocation of it if the channel changes or alterations must be made. (Watson-Fia) W69-03263

LICENSES TO BE REVOCABLE AND TO EXPIRE IN FIVE YEARS - BOSTON HARBOR LICENSES - FORM, HOW GRANTED AND CONSTRUED.

Mass Ann Laws ch 91, secs 15-18 (1967).

Descriptors: *Massachusetts, *Legislation, *Permits, *Public lands, Docks, Administrative agencies, Bridges, Connecticut, Rivers, Tidal waters, Tides, Dams, Flow, Great ponds, High water mark,

Pile driving, Landfills, Navigable waters, Riparian n rights, Legal aspects, Cities, Inlets (Waterways). Identifiers: *Boston Harbor, Harbor lines, Deeds, Registration.

Every license or authority issued by the Commonwealth of Massachusetts since 1868 as to rights in public lands controlled by the Department of Public works is revocable at the discretion of the general court, and shall expire in 5 years from its date. Excepted are valuable structures, fillings, or enclosures actually and in good faith built or made under the authority or license during its term. Any compensation paid for such license or authority must be repaid on revocation. All licenses or authorities granted in Boston Harbor are terminated or subject to forfeiture in the case of nonuse for an unreasonable time. No license or other authority to build structures upon or fill up or enclose any ground mentioned in this chapter shall be contrued to interfere with harbor lines established by law or the legal rights of any person. Procedures for the granting of licenses is outlined. Included in the procedure is notification to the aldermen or the procedure is notification to the aldermen or selectmen of any towns involved. Any license shall be void unless, within one year after its date, the license and the accompanying plan are recorded in the registry of deeds for the county or district where the work is to be performed. (Watson-Fla) W69-03264

SURVEYS AND IMPROVEMENTS OF HARBORS - ESTABLISHMENT OF HARBOR LINES - GREAT PONDS DEFINED.

Mass Ann Laws ch 91, secs 31-36 (1967).

Descriptors: *Massachusetts, *Harbors, *Great ponds, *Damages, Legislation, Water law, Ad-ministrative agencies, Rivers, Financing, Eminent domain, Surveys, Connecticut, Maps, Storms, Federal government, Banks, Coasts, Docks, Piers.

The Department of Public Works of the Commonwealth of Massachusetts may make surveys and improvements for the preservation of harbors and may repair damages caused by storms along the coast line or river banks of the commonwealth. The department may take by eminent domain or purchase any land necessary for the improvements. The department is also instructed to survey that portion of the Connecticut River lying within the commonwealth. The department may also sell, at such prices and conditions as it prescribes, maps prepared by it in connection with waterways and public lands. The department may, after hearings with interested parties, prescribe lines in any harbor of the commonwealth. The general court must approve these lines. If the lines are approved, no wharf, pier, or other structure may extend into the harbor beyond the lines. The department may also apply to Congress for appropriations for the protection and improvement of any harbor in the commonwealth. Great ponds are defined as ponds containing in their natural state more than ten acres of land. (Watson-Fla) W69-03270 The Department of Public Works of the Common-

REMOVAL OF WRECKS ON SHORES OR IN TIDE WATERS.

Mass Ann Laws ch 91, secs 38-45 (1967).

Descriptors: *Massachusetts, *Legislation, *Ships, *Navigation, Water law, Administrative agencies, Federal government, United States, Shores, Tidal waters, Rivers, River basins, Financing. Identifiers: *Ship wrecks.

The Department of Public Works of the Common-The Department of Public Works of the Common-wealth of Massachusetts is directed to see that all wrecked vessels on the shores or in the tide waters of the commonwealth are removed. If the owner of the vessel cannot be determined or if he does not remove it after notification, the department is em-powered to remove the vessel. The owner is then li-able for all the expenses incurred in the removal. If the owner does not pay the expenses within ten

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days after the removal is complete, the vessel may be sold to cover the expenses. An insurer of the vessel is not liable for the expenses of removal unless he has exercised some act of ownership or control over the vessel or received the proceeds of the sale. The department is also directed to make application to the government of the United States for reimbursement of expenses of removal for which it is liable. (Watson-Fla) W69-03271

BREAKING UP, DISPOSAL, AND GROUNDING OF CERTAIN FLOATING STRUCTURES - REMOVAL OF WHALES.

Mass Ann Laws ch 91, secs 46-49A (1967)

Descriptors: *Massachusetts, *Ships, *Navigation, *Permits, Legislation, Water law, Administrative agencies, Shores, Tidal waters, Boats, Disposal, Salvage value, Harbors, Financing, Safety, Public health, Mammals. Identifiers: *Whales.

The owners of any vessel, scow, lighter, or similar floating structure lying within any harbor of the Commonwealth of Mass who wish to break up and dispose of their vessel must first obtain a license from the Department of Public Works. The license must state where and in what time period the work is to be done. If the work is not completed within the specified time the department may complete the work at the expense of the owner. Anyone who starts such work without a license is subject to a fine up to \$500. Whoever grounds or abandons any vessel, scow, lighter, or other floating structure within any harbor of the commonwealth or upon any shores of the commonwealth without the pershores of the commonwealth without the permission of the owner shall be subject to a fine up to \$500 unless the vessel is grounded because of an emergency. The Department of Public Works is directed to remove any whales or other mammals deposited in the tidewaters or shores of the commonwealth if the department deems it injurious to the public health. (Watson-Fla) W69-03272

LICENSING FOREIGN CORP ENGAGED IN WRECKING OR SALVAGING - SUPERVISION OF TRANSPORTATION AND DUMPING OR DREDGED MATERIAL - ARREST WITHOUT WARRANT.

Mass Ann Laws ch 91, secs 50-58 (1967).

Descriptors: *Massachusetts, Legislation, Water law, Administrative agencies, *Permits, Boats, Tidal waters, Ships, Navigation, Harbors, *Salvage value, Navigable waters, United States, *Dredging, Financing, Inspection, Channels, Rivers, Bays. Identifiers: *Arrest.

Foreign corporations engaging in the business of wrecking or salvaging in the navigable waters of the Commonwealth of Massachusetts must obtain a license, which is good for one year. Failure to obtain the permit subjects the violator to a fine up to \$300. The Department of Public Works has supervision over the transportation and dumping of all material dredged in the tide waters of the commonwealth or transported in boats to be dumped in the tide waters. The department may employ necessary inspectors to accompany the boats. The person who has the permit to dump must pay the cost of all supervision. Any officer qualified to serve criminal process may, within his jurisdiction, arrest without a warrant any person found in the act of committing a misdemeanor in or upon any of the rivers, harbors, bays, or sounds of the commonwealth. (Watson-Fla)

PUBLIC BEACHES - CONTROL, SUPERVISION, AND PRESERVATION.

Mass Ann Laws ch 91, secs 60-62 (1967).

Descriptors: *Massachusetts, Legislation, Water law, Administrative agencies, *Beaches, Recreation, *Recreational facilities, Oceans, *Scenery.

The control and supervision of all public beaches in the Commonwealth of Massachusetts, including the Salisbury Beach Reservation, is placed in the division of waterways of the department of public works. The department is authorized to make and enforce all necessary rules and regulations for the government and use of the beaches. The department is directed, while developing the beaches for recreational purposes, to preserve to the fullest extent possible all the beaches in their natural, simple, scenic beauty. (Watson-Fla) W69-03275

IN RE NEVERSINK RIPARIAN SECTION NO 1 SULLIVAN COUNTY (CONDEMNATION PROCEEDINGS TO ACQUIRE ADDITIONAL WATER SUPPLY).
2 Misc 2d 38, 154 N Y S 2d 824-832 (Sup Ct

Descriptors: Eminent domain, Riparian Rights, Alteration of flow, *Condemnation value, Swimming, Water law, *New York, Administrative decisions, *Water supply, Recreation facilities, Easements, Comdemnation, Judicial decisions, Legal aspects, Public rights, *Diversion.

City of New York instituted condemnation proceedings to acquire additional water supply and moved to confirm commissioners' appraisals of properties of downstream riparian owners. The down stream owners filed a cross-motion to reject the appraisals. The Supreme Court held the appraisals were not inadequate, although not sufficient to pay for construction of an artificial bathing area to replace the natural swimming facilities which the river provided. Power of a court to reject commissioners' appraisals in condemnation proceedings is confined to narrow limits, and every intendment is in favor of the action of the commis sioners. The appraisals must shock the conscience of the court or be grounded in a erroneous legal theory in order to be set aside. The true measure of damages for injury to lower riparian owner by a permanent diversion of water is the difference in value of the property before and after the diversion. (Hoffman-Fla) W69-03276

PEOPLE V JOHNSON (TRESPASS ON PRIVATELY OWNED UNDERWATER LAND).
7 Misc 2d 385, 166 N Y S 2d 732-740 (Pol Ct 1957).

Descriptors: New York, Judicial decisions, *Navigable waters, *Shellfish, *Beds, Water law, Navigation, Fishing, Non-navigable waters, Legal aspects, Clams, Aquatic soils, Permits, Benefits, Public rights.

Identifiers: Ferae naturae, Trespass.

Three individuals pleaded guilty to trespass for raking shellfish upon posted and privately owned underwater land. The trial court denied their motions derwater land. The trial court defined tief indictions to arrest judgment, holding that the relative immobility of shellfish, their way of living in the land, and the landowner's ability to maintain more than nominal control over them makes 'clamming' less a nominal control over their makes training less a utilization of public waters than an activity closely related to the ownership of the underlying land, and that the public right of fishing does not include raking for shellfish on private lands under navigable waters. Any implied license defendants previous ble waters. Any implied license defendants previously had with regard to the privately owned underwater land ended when the owners posted a no trespassing sign. Land underlying navigable water is open to the public for activities closely related to the water, but, where the activity involves disturbance of the land not directly connected with enjoyment of the water, the character of the activity as private or public must be determined by ownership of land. (Hoffman-Fla) W69-03277 ADAMS V CREWS (TITLE TO SUBMERGED LAND).

105 So 2d 584-593 (2d DCA Fla 1958).

Descriptors: *Florida, *Ownership of beds, *Lake beds, *Water law, Judicial decisions, Legal aspects, Public benefits, Navigable waters, Beds, Dredging, State governments, Riparian rights, Legislation, Administrative decisions.
Identifiers: State ownership, Public trust doctrine.

Plaintiffs owned property on the shore of a naviga-ble lake. Defendants claimed title to a thirty-five acre tract which plaintiffs assert is all submerged land in the lake. When defendants began to dredge the lake bottom to obtain fill for their submerged land, plaintiffs requested an injunction to stop these. Plaintiffs asserted that tax deeds of the defendant's successor in title were void, and that the dredging and filling has interfered with and obstructed the use of the lake for navigation, recreation, and commerce. The court found that the tax deeds of the defendant's predecessor in title were issued by the trustees of the state's Internal Improvement Fund. However, this did not estop the state from asserting, through the Trustees of the Fund, the invalidity of the tax deed and the rights of the public to the submerged land as sovereignty land at a later date. The court held in this interlocu-tory appeal that the deeds were void, and the submerged land was vested in the state in trust for public usage. The decision of the lower court was affirmed. (Scott-Fla)
W69-03281

STEIN V BROWN PROPERTIES, INC (TITLE TO SUBMERGED LANDS).

104 So 2d 495-500 (Fla 1958).

Descriptors: *Florida, *Boundaries (Property), Judicial decisions, *Ownership of beds, State governments, Contracts, *Beds, Beds under water, Landfills, High water mark.

Plaintiff sued defendant for specific performance of a contract to convey land. One portion of the property was submerged land. Plaintiff also requested the court to determine the amount of land to which defendant held marketable title. The court found that the property involved was of three types: an upland portion, a part subject to overflow of the tides, and a portion submerged in the ocean. The court held that although the 'source' of title to submerged land adjacent to upland is the statutory right of raising it above the surface of the water by filling, no title is acquired until such submerged filling, no title is acquired until such submerged land is filled in or permanently improved. The fact that the original grant to defendant's predecessor in title contained a description of a specific number of acres did not give that party title to that portion of land under ocean or tidal waters, since such land remained vested in the state. Specific performance was granted only as to the upland portion of the land involved. (Scott-Fla) W69-03283

EMINENT DOMAIN -- RIGHT OF; BY WHOM RIGHT MAY BE EXERCISED. N C Gen Stat sec 40-2 (1967).

Descriptors: *North Carolina, *Eminent domain, *Legislation, Local governments, *Right-of-way, Sewage districts, State governments, Condemnation, Legal aspects, Utilities, Public utilities, Electric power, Water control, Water supply, Railroads,

The right of eminent domain may be exercised for the purpose of constructing roads, canals, certain pipelines, lines of wires, and other works which involve a public use or benefit, by certain enumerated types of public and private bodies. These bodies include certain railroads, municipalities, public utilities, school districts, and governmental agencies. (Scott-Fla) W69-03289

Group 6E-Water Law and Institutions

MCCORD V MISSOURI CROOKED RIVER BACKWATER LEVEE DISTRICT (MOTION TO ABATE CONDEMNATION PROCEEDINGS). 295 SW 2d 42-46 (Mo 1956).

Descriptors: *Missouri, *Condemnation, Judicial decisions, Legislation, Reclamation, Benefits, Assessments, Damages, Eminent domain, Legal

Identifiers: Levee district, Motion to abate.

Land owned by the respondents was assessed benefits in the amount of \$2,988, and \$601.40 was awarded as damages for the proposed taking of 7.29 acres of land by a levee district through a condemnation proceeding. The levee district has not, demnation proceeding. The levee district has not, since the filing of the report of commissioners with the Clerk of the Circuit Court, paid respondents for the land proposed to be taken. Respondents brought this action to abate condemnation and to quiet title in themselves. Their claim was based on a statute requiring all sums awarded to be paid within 5 years from the date of filing the commissioners' report. The court held that this time period had reference to the date of filing in the office of the County Recorder rather than to the date of filfrom the office of the Circuit Court. The court found for the levee district. (Childs-Fla) W69-03292

SCHULTZ V WILSON (TIDAL WATERS).

44 N J Super 591, 131 A 2d 415-425 (App Div

Descriptors: Judicial decisions, Legal aspects, *New Jersey, *River beds, *Tidal waters, Riparian rights, Beds, *Ownership of beds, Navigable rivers, Administrative agencies.

Plaintiff filed objections to a statutory grant by the state of tidewater land to the defendant. Plaintiff claimed paramount title by reason of diverse con-veyances dating back to an original grant from the Indian inhabitants. The court held that the legal right to the land was in the State and not the Indiright to the land was in the State and not the Indi-ans. Plaintiff's contention that before the state can make a riparian land grant the river must be naviga-ble, is without merit. All tidal rivers in New Jersey are public rivers and the criterion of navigability is rejected as a test of whether title to the beds are in the state. (Molica-Fla) W69-03294

EXISTING RIGHTS REMEDIES **AND**

PRESERVED; LIMITATIONS.
For primary bibliographic entry see Field 04A.
For abstract, see . W69-03297

VIOLATIONS AND CIVIL LIABILITY. N Y Conserv Law sec 630 (McKinney 1967).

Descriptors: *New York, Legislation, State governments, Conservation, Water resources, *Administration, Administrative agencies, Legal aspects. Identifiers: *Fines, Violators.

This section provides for fines to be levied against violators of Article 5. Such fines, if levied, are recoverable in an action instituted in the name of the water resources commission by the attorney general. An action for the recovery of a penalty under this section may be settled or compromised by the commission at any time prior to judgment being entered. (Scott-Fla)

W69-03298

PURPOSE AND FINDINGS.

N Y Conserv Law sec 801 Art I sec 1.3 (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, Conservation, *Water resources, Planning, Water

resources development. Water policy, *Administration, *Public benefits, *River basin commissions, Local governments, Legal aspects.

The legislatures of the signatory parties to the compact declare that the water resources of the basin are affected with a local, state, regional, and naare affected with a local, state, regional, and national interest. The signatory parties have the sovereign right and responsibility to control said water resources, and, by this compact, provide for a joint exercise of such powers in the common interests of the people of the region. A single administrative agency is essential for effective and economical direction, supervision, and coordina-tion of efforts and programs of the federal, state, and local governments and of private enterprise. Scott-Fla W69-03300

CONDEMNATION PROCEEDINGS, RIGHTS OF WAY AND EFFECT ON RIPARIAN RIGHTS. N Y Conserv Law sec 801 Art 14 secs 14.14, 14.16, 14.17, 14.19 (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, Conservation, Water resources, Planning, Water resources development, Water policy, Administration, *Condemnation, Riparian rights, *Right-of-way, Easements, River basin commissions, United States, Pipes, Conduits, Beds.

The Commission shall have the power to obtain, by condemnation, any interest in lands, submerged lands, and riparian and water rights. This grant of power includes, but is not limited to, the power to condemn any private property devoted to the public use. Such power shall be exercised in accordance with existing federal and state law. The Commission is granted the right to locate any lines, prizes conduits and similar facilities in over Commission is granted the right to locate any lines, pipes, conduits, and similar facilities in, over, under, or across any street or highway dedicated to public use. Anyone violating, or attempting or conspiring to violate, any provision of this compact, or any rule, regulation or order of the commission shall be subject to certain enumerated penalties. Nothing in this compact shall be construed as affecting the existing law of the member states relating to riparian rights. (Scott-Fla) W69-03304

INTERNATIONAL CONFERENCE ON WATER

FOR PEACE 1967.
For primary bibliographic entry see Field 06B. For abstract, see . W69-03305

PUBLIC WORKS (ACQUISITION OF WATER RIGHTS FOR PUBLIC PURPOSES).
N J Stat Ann sec 40:137-1 (1967).

Descriptors: *New Jersey, *Navigable waters, *Riparian lands, *Public rights, Legislation, Docks, Bulkheads, Piers, Eminent domain, Condemnation, Local governments, Legal aspects, Construction.

This act authorizes towns fronting on navigable waters of this state to acquire riparian lands or lands underwater and other lands and rights in land incident thereto. Said towns are authorized to construct, establish, and maintain on such lands public docks, warehouses and other structures, wharves, piers, bulkheads and shipping facilities, and to regulate use of the same. (Shevin-Fla) W69-03412

WATER FRONT IMPROVEMENTS. N J Stat Ann secs 40:92-1-40:92.11 (1967).

Descriptors: *Legislation, *New Jersey, *Bulkheads, Engineering structures, Jetties, Administration, Governments, Local governments, Riparian waters, Atlantic Ocean, Legal aspects, Cities, Navigable waters, Financing, Maintenance, Maintenance costs.
Identifiers: *Water front improvement.

Sections 1 through 11 of chaper 92, title 40 pertain to water front improvements. Section 1 allows the governing body of any borough to construct and maintain bulkheads, jetties, and other works along any navigable waters other than the Atlantic Ocean. Section 2 provides that all improvements shall be covered by Chapter 56 of this title. Bonds for the cost of such improvements may be issued in accordance with the provisions of article 1 of chapter 1 of this title. Section 3 allows boroughs to accept contributions from the state or from the county toward the cost of the improvements. Section 4 empowers the governing body, by ordinance, to provide for the maintenance of existing bulkheads or other works within the borough. Section 5 provides that improvements to be made by landowners should be made within 60 days. Section 6 provides that, if the owners fail to maintain the bulkhead, the governing body shall have the work done and the cost thereof assessed upon the land. Such assessment shall become and remain a first and paramount lien. Section 7 empowers the governing power to issue improvment certificates to pay for the cost of maintaining bulkheads and other work. Section 7.1 provides for the acquisition by the governing body of any borough bordering on the Atlantic Ocean of land for purposes of establishing a place of resort for public health and recreation. Section 8 allows owners upon which assessment has been made to pay in yearly installments. Section 9 allows the governing body to build bulkheads, jetties, and other works along the Atlantic Ocean. Section 10 provides that all improvements shall be governed by chapter 56 of this title and bonds can be issued. Section 11 allows the borough to accept contributions from the State or county to pay for improvements. (Heckerling-Fla) W69-03413 to pay for the cost of maintaining bulkheads and

MUNICIPALITIES GENERALLY (PERMIT FOR BUILDING IN BED OF MAPPED STREET OR DRAINAGE RIGHT OF WAY).

N.J.Stat. Ann sec. 40:55-1.38 (1967).

Descriptors: *New Jersey, *Cities, *Drainage, *Permits, Legislation, State government, Right-of-way, Legal aspects. Identifiers: Municipal mapping.

Section 40:55-1.38 requires that a permit be ob-Section 40:55-1.38 requires that a permit be obtained from a municipality authorizing the construction of any building upon a plot wherein lies the bed of a mapped street, drainage right of way, park or playground location. The issuance of such a permit is proper if the construction shall not cause more than a minimum change in the official map of the municipality and will increase the cost of opening such street or drain as little as is practicable. (Logan-Fla) W69-03414

MUNICIPALITIES GENERALLY - GENERAL POWERS.

N J Stat Ann secs 40:48-7, 40:48-8.13 (1967).

Descriptors: *New Jersey, *Legislation, *Cities, *Taxes, State governments, Income, Construction, Repairing, Bulkheads, Jetties, Piers, Sewers, Sewer system, Drainage systems, Beaches, Operation and maintenance.

The New Jersey legislature authorizes taxation by municipalities and describes the purposes for which the resulting revenue is to be used. The purposed the resulting revenue is to be used. The purposed specified are: (1) the construction, reconstruction or repair of bulkheads, jetties, boardwalks, piers, streets, street-ends, sewers, sewer systems and drainage systems; (2) the repair of damage to beaches; (3) the construction, reconstruction or repair of any facility provided to attract patronage as a seaside or summer resort; (4) the payment of any principal or interest, or both, on indebtedness incurred for any of the foregoing purposes; (5) the payment of all administration costs. (Logan-Fla) W69-03415

PUBLIC UTILITIES - ARTICLE 9 - BRIDGES, VIADUCTS AND TUNNELS.N J Stat Ann secs 48:12-42 (1940); 48:12-41, 48:12-43-48:12-45 (1968-69 Supp).

Descriptors: *New Jersey, *Legislation, *Bridge construction, *Piers, State governments, Bridges, Railroads, Ownership of beds, Navigable rivers, Streams, Bays, Tunnels, Delaware River, Con-demnation, Tidal waters, Non-navigable waters, Operation and maintenance. Identifiers: Draw, Pivot draw.

Article 9 deals with railroad company handling of bridges, viaducts, and tunnels. Section 48:12-41 gives railroads the right to build piers, bridges, and viaducts over and tunnels under any navigable or non-navigable stream, river, or bay. Specific requirements are set out for draws of bridges and viaducts. Also, lands under water when the control of the stream of of the s viaducts. Also, lands under water belonging to the state can be taken only with the consent of the state unless this land is twenty-five feet or more under the bed of the water. Section 48:12-42 requires that on navigable rivers, etc, the company must maintain a lighting system to warn of the presence of a draw and must keep some person at each bridge to open the draw for vessels passing beneath it. Section 48:12-43 provides that if the company feels it is impractical to construct a draw they may apply to the state for a determination of the proper type structure for that site. Section 48:12-44 allows for the taking and condemnation of land by the company and contains specific provisions in respect to bridges over the Delaware River. Section 48:12-45 authorizes construction of tunnels; specifying, in addition the mode of construction. Also, the procedure for procurement of lands and easements upon which such tunnels are constructed is set out. (Logan-Fla)
W69-03416

WATER POWER COMPANIES ALONG TRIBUTARIES TO BARNEGAT BAY.

N J Stat Ann secs 48:14-20, 48:14-21.1 (1968-69 Supp).

Descriptors: *New Jersey, *Legislation, *Electric Power Industry, *Survey, State government, Rivers, Streams, Dams, Reservoirs, Ponds, Locks, Weirs, Bridges, Canals, Legal aspects. Identifiers: Barnegat Bay.

Article 3 allows every water power company to construct a dam in any river or stream tributary of Barnegat Bay and to examine and survey all proposed sites for dams, reservoirs, ponds, locks, weirs, gates, bridges, canals, race and power sta-tions, as well as land which may be overflowed by erection of the dams. It also permits these companies to take real property, rights, franchises, privileges, or easements necessary for the construction of the above works. (Logan-Fla) W69-03417

SEWERAGE COMPANIES.

N J Stat Ann secs 4813-16 (1940), 48:13-9-48:13-14 (1968-69 Supp).

Descriptors: *New Jersey, *Legislation, *Sewage systems, Pipelines, Conduits, Sewers, Eminent domain, Surveys, Measurements, Mapping, Operation and maintenance, Construction, Cities, Legal aspects.
Identifiers: State corporations.

Chapter 13 sets out the powers and procedures granted to corporations organized by the State to handle all sewerage construction, operation, and maintenance. Every sewerage company so incorporated may enter upon any lands in the neighborhood of the municipality and make preliminary surveys, examinations, explorations, measurements, and levelings as necessary. The company may lay its pipes and conduits under such public roads, streets, etc, as required. Such pipes shall be layed at least three feet below the surface after the State

Department of Health receives and approves a map and specifications of the proposed system. Each sewerage utility has the right to exercise the power of eminent domain. In conjunction with the Board of Public Utility, the company may establish prices, rents or restrictions for use of the system by property owners. (Logan-Fla) W69-03418

ECONOMIC DEVELOPMENT.

N J Stat Ann secs 13:1B-1, 13:1B-7, 13:1B-9-13:1B-13, 13:1B-47-13:1B-51 (1968).

Descriptors: *Legislation, *New Jersey, *Administrative agencies, *Natural resources, State government, Decision making, Programs, Economics, Riparian rights, Erosion control, Water resources

The purpose of this act is to establish the Department of Conservation and Economic Development. All the functions, powers, and duties of the Economic Council and Division of Commerce in the existing Department of Economic Development shall be transferred to Department of Conservation and Economic Development. All functions, powers, and duties of State Commissioner of Conservation of the existing State Department of Conservation and its councils are transferred to the new Department. The new Department shall, through the Division of Resource Development, formulate policies and conduct research in the area of conservation and protection of the state natural resources within the Division of Resource Development shall be established a council to help formulate policies for development of natural and economic resources. All functions, powers, and duties of the Division of Water Policy and Supply shall be exercised through that Division in the Department of Conservation and Economic Development. The Division shall have a council to formulate policies for preservation and improvement of state water supply facilities. The Council shall also study and make recommendations regarding the work of the Division. (Stewart-Fla) W69-03419

DIVISION OF NAVIGATION

N J Stat Ann secs 13:1A=<*=B?+::1A-32.1 (1968).

Descriptors: *Legislation, *New Jersey, *Administrative agencies, *Decision making, Beach erosion, Riparian leases, State government, Occupations, Wages, Financing, Contract negotiations, Shoals, Reefs, Budgeting, Legal aspects.

This bill eliminates the Department of Commerce and Navigation and establishes a Division of Navigation under the Department of Conservation. Within this Division of Navigation is a Navigation Council which replaces the Board of Commerce and Navigation. Council members shall be appointed by the Governor and serve, without compensation, for 5 year terms. The functions, powers and duties, records and property of both the Department and Board of Commerce and Navigation shall be transferred to the Division of Navigation. No action shall be taken by the Council except upon approval of Commissioner of Conservation. The Council shall formulate comprehensive policies for prevention of beach erosion. The employees of both the Department and Board of Commerce and Navigation shall be transferred to the Division of Navigation without a change in salary or civil service status. All appropriations available to both the Department and Board of Commerce and Navigation are transferred to the Division of Navigation. The Department of Conservation, Division of Navigation, along with the Governor, may sell, let, lease, or grant any island, shoal or reef, situated in tidal waters which the State owns or has an interest, upon such terms as the interests of the State may require. (Stewart-Fla) W69-03420

CONSERVATION AND DEVELOPMENT.

N J Stat Ann secs 13:1-11, 13:1-16, 13:1-18--13:1-20, 13:1A-8--13:1A-12 (1968).

Descriptors: *New Jersey, *Conservation, *Administrative agencies, *State governments, Legislation, Water resources development, Water conservation, Water supply, Administration, Legal aspects, Planning.

Identifiers: Passaic River, Water supply facilities.

The statutes of New Jersey, in setting up a Department of Conservation and Development, have provided for a Governing Board to control the activity of various divisions; one such is the Division of Water Policy and Supply. This Division consists of a nine man council appointed, with Senate approval, by the Governor. The Division serves to centralize all previous separate water managing agencies in the State, i.e. Delaware and Raritan Canal, State Water Policy Commission, and the Passaic Valley Flood Control Commission. The powers of the council are: (a) to Formulate comprehensive policies for the preservation and improvement of the water supply facilities of the state; (b) to survey the needs of the State for additional water supply facilities and formulate plans for the development of such facilities. (Logan-Fla) W69-03421

BEACH FRONT REPAIR AND DREDGING OF STREAMS.

N J Stat Ann secs 12:6A-1--12:6A-4 (1968).

Descriptors: *Legislation, *New Jersey, *Erosion control, *Beach erosion, Windbreaks, Shore protection, Sea walls, Bulkheads, Jetties, Administrative agencies, State governments, Allotments, Dredging, Channel improvement, Bays, Inlets, Legal aspects, Atlantic Ocean, Sea water.

The purpose of this act is to prevent and correct erosion damage to the New Jersey coast and certain inland areas. The Act authorizes and empowers the State Department of Conservation and Economic Development to repair or construct bulkheads, seawalls, or any appurtenant structures on every shore front along the Atlantic Ocean and bay areas. This authorization also encompasses certain inland rivers and waterways as well as the upper and lower New York bay areas. The Division of Navigation is further authorized to use facilities and services of the Federal Government or any State, county, or municipality in New Jersey, as well as any funds now or later made available by any of the above sources for purposes of arresting beach erosion and protecting the water front generally. The Division of Navigation is further authorized to dredge and remove any obstructions in every New Jersey waterway to a depth and width to be determined by the Council of the Division. The Division is also empowered to erect such bulkheads or structures as are necessary to prevent ero-sion and to stabilize the shore in the vacinity of any inlet along the New Jersey coast. (Stewart-Fla) W69-03422

NAVIGATION.

N J Stat Ann secs 12:4-1-12:4-15 (1968).

Descriptors: *Legislation, *New Jersey, *Navigable waters, *Waste disposal, Channel markers, Buoys, Ice jams, Sewerage disposal, Wharves, Piers, Obstructions to flow, Solid wastes, Legal aspects, Navigation.

The purpose of this legislation is to insure unhindered navigation in the New Jersey waterways. Any person may remove, provided there is minimal detriment to the owner, all trunks and limbs which interfere with navigation. Any person who carelessly or willfully breaks or destroys any buoy, beacon or other device fixed in navigable waters is subject to a \$50 fine. The act also authorizes ice boats to keep the Delaware River open. The act establishes a procedure for removal of sunken or stranded ves-

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sels from navigable waters. Any such vessels not removed within 30 days are forfeited to the state. The county removing any such forfeited to the state. The county removing any such forfeited vessel shall be reimbursed out of the state treasury but such amount shall not exceed \$1000. Article 3 provides that no person shall throw or cause to be thrown or deposited any solid material of any kind into the deposited any solid material of any kind into the navigable waters of specified bay areas. This prohibition does not apply to fishing rights and the discharge of sewerage by the city. Violation of the article is a misdemeanor and the commissioners of pilotage are authorized to seize and hold any vessel violating the above provisions. The commis of pilotage shall prosecute all violations of this article. Fines collected constitute a fund in the hands of commissioners from which to pay expenses of enforcement. (Stewart-Fla) W69-03423

LICENSE FOR TAKING OYSTERS OR CLAMS. N J Stat Ann secs 50:2-1-2, 50:2-6.1-6.2, 50:2-6.4 (1955).

Descriptors: *Legislation, *New Jersey, *Shellfish, *Dredging, Clams, Oysters, Permits, Commercial shellfish, Commercial fishing, Legal aspects, Atlantic Ocean, Boats.
Identifiers: Raritan Bay.

The cited sections refer generally to shellfish and shellfishing. Sections 50:2-1 through 50:2-6.4 refer to licenses for the taking of oysters or clams. In section 50:2-1, the statute provides that a license is required to catch or take oysters or clams from any natural oyster or clam grounds in New Jersey; section 50:2-2 provides that licenses will be issued only to state residents, except that a license will be issued to a nonresident for the months of June, July, August and September. New York citizens may have a license to take clams from Raritan Bay, but no nonresident license holder may sell the oysters or clams taken under the license; section 50:2-6 allows revocation of the abovementioned license if any provision of this title or any rule of regulation of the Board of Shell Fisheries is violated; section 50:2-6.1 allows no dredging of sea clams without a license. This license is valid only clams without a license. This license is valid only for the Atlantic Ocean, and no boat or vessel will be licensed unless its owner is a resident of New Jersey; section 50:2-6.2 provides that dredging may be only by a single dredge on each boat, and that dredging may not be done between June 1 and September 13 each year within one mile of mean low watermark; finally section 50:2-6.4 makes violators of this act, or of rules and regulations made and regulations made and regulations made and regulations made and promulgated under it, liable to a fine of not less promulgated under it, liable to a fine of not less than \$50.00 nor more than \$300.00 for the first offense, not less than \$100.00 nor more than \$500.00 tense, not less tan \$100.00 nor more than \$500.00 for any subsequent offense, and any penalty shall be collected or enforced in a summary manner, without a jury, in any court of competent jurisdiction. (Heckerling-Fla) W69-03424

JERUZAL V HERRICK (STATUTORY AUTHORITY OF DRAIN COMMISSIONER). For primary bibliographic entry see Field 04A.
For abstract, see . W60-03426

STATE V 6.0 ACRES OF LAND (RIPARIAN OWNERS' RIGHT TO ACCRETION LAND).

139 A 2d 75-78 (N H 1958).

Descriptors: *New Hampshire, *Riparian rights, *Accretion (Legal aspects), *Boundary disputes, Judicial decisions, Rivers, Water law, High water mark, Banks, Boundaries (Property), Jetties, Dikes, State governments, Bulkheads, Legal aspects, Landfills, Alluvium, Riparian lands.

The State acquired title to a strip of land abutting the easterly side of the Hampton River to its mean high water mark. The westerly boundary line of this tract intersected the boundary line of the clai-

mant's property, which was delineated by a wooden bulkhead. The bulkhead also bordered upon the river at its mean high water mark. The state filled in the land easterly of its strip. As part of the development project, the state built a rip-rap dike, parrallel with and some ten feet westerly of the western side line of the state's strip. It intersected the bulkhead at the edge of the claimant's property. The State then filled behind the dike. Later, six acres of land was formed by natural accretion caused by the ebb and flow of the river. The land thus formed adjoined the westerly face of the dike and connected with the southwesterly side of the bulkhead. The State petitioned for acquisition of the accretion.

The lower court approved the master's ruling that the general principle governing the apportionment of accretion among adjoining riparian owners should be followed. The rule followed was, in the case of a bending shoreline, the dividing lines across the alluvion are laid down by connecting the extremities of the upland sides at the old shore with the point of division on the new shore as fixed by proportion. The appellate court affirmed, and disallowed claimant's claim to the entire accretion tract. (Wheeler-Fla) W69-03428

TRANSFER OF CERTAIN POWERS, DUTIES, FUNCTIONS AND RESPONSIBILITIES OF THE DEPARTMENT OF CONSERVATION AND DEVELOPMENT.

N C Gen Stats sec 143-355 (1967).

Descriptors: *North Carolina, *Administration, *Well regulations, *Water permits, Legislation, Well permits, Planning, Water law, Water use, Drilling, Administrative agencies, State governments, Water resources development, Long-term Identifiers: *N C Dept of Water Resources.

Identifiers: *N C Dept of Water Resources.

Duties transferred from the Department of Conservation and Development to the Department of Water Resources include: (1) requesting the congressional delegation to apply for federal water funds; (2) planning long-range water resources programs; (3) preparing state legislation pertaining to water resources; (4) making hydrological engineering studies and reports; (5) maintaining harbors and channels; (6) preparing flood control and hurricane protection plans; (7) providing advice on tidewater, river and watershed development; (8) working with national agencies in development of water resources; and (9) planning long-range flood plain management programs. Other provisions include the requirement of annual registration with the Department of Water Resources of all persons engaged in well drilling with power equipment. All persons drilling wells must furnish the Department of Water Resources with sample of cutting from each well upon request. Data on each well drilled shall be reported to the Department within 30 days of completion. Persons withdrawing or using surface or ground water shall upon request report monthly to the Department of Water Resources the identity of the supply and amount of water used, water for domestic use being excluded. (Helwig-Fla) Fla) W69-03429

FIVE LAKES OUTING CLUB V HORSESHOE LAKE PROTECTIVE ASS'N (OWNERSHIP OF NON-NAVIGABLE LAKES).

288 S W 2d 942-945 (Ark 1956).

Descriptors: *Arkansas, *Ownership of beds, *Navigable waters, Judicial decisions, Lakes, Levees, Prescriptive rights, Water level fluctuations, Legal aspects.

This action was brought to compel the owners of land on which four small lakes were located to remove the levees they had constructed across the end of two of these lakes at points where they joined a larger, navigable lake. The court held that though a rise in the water level in the navigable lake

would cause a rise in the smaller lakes, the ownership of the smaller lakes was not affected. Though the state had acquired prescriptive title to certain lands inundated by a rise in the level of the adjoining navigable lake, title to the smaller lakes had not been acquired by prescription. Since the smaller lakes were not part of the navigable lake, the owners of title to the smaller lakes had the right to build levees across the lakes. (Childs-Fla) W69-03433

TRI-COUNTY DRAINAGE DISTRICT V MOR-RISON (RIGHT OF A COUNTY TO WITHDRAW FROM ORIGINAL DRAINAGE DISTRICT).

295 S W 2d 781-790 (Ark 1956).

Descriptors: *Arkansas, Judicial decisions, *Taxes, Legislation, *Drainage districts, *Local govern-ments, Legal aspects, Drainage system, Main-

Two actions were consolidated for appeal. The first involves the question of the right of a county to withdraw from the original drainage district. State statute provides for such withdrawal providing the original district has no outstanding unpaid bonds or other evidences of indebtedness. Contingent claims other evidences of indebtedness. Contingent claims against the district for attorneys' and engineering fees will not prevent a county from withdrawing from the district. The second question involves the power of the original drainage district to levy taxes on the land of all counties in the original district even though counties had subsequently withdrawn from such district. It was found by the court in activation of the c cordance with state statute that the taxes were proper since they would finance cleaning of existing ditches to provide adequate outlets for the entire drainage system of the original district. (Childs-W69-03436

PAINTER V PENNSYLVANIA PUBLIC UTILITY COMMISSION (PREFERENCE GIVEN EXISTING WATER COMPANIES IN GRANTING EXTENSIONS).

194 Pa Super 548, 169 A 2d 113-117 (1961).

Descriptors: *Pennsylvania, *Administrative agencies, *Permits, *Competition, Judicial decisions, Public utility districts, Regulation, Technical feasibility, Water zoning, Water supply, Alternative costs, Water rates.

A proceeding on an application by an existing water company for the right to serve additional adjacent territory, and subsequent applications by proposed new water companies to serve the same territory were brought by Plaintiff. The defendant, a public utility commission, granted the existing company's application, and the other applicants brought this action. This court affirmed, holding that the findings of the commission supported its granting the existing company's extension. The evidence supported the commission's contention that the facilities of the existing company were adequate to serve the added territory, and that the company selected was able to provide satisfactory service in the new area. The extent of competition in any field of public utility is a matter of adminisservice in the new area. The extent of competition in any field of public utility is a matter of administrative discretion vested in the commission. Generally competition among non-carrier public utilities is deleterious and not, except for rare instances in the public interest. An existing water company, ready, willing and able to extend its service into new territory, should be given preference over proposed competitors. (Blunt-Fla) W69-03452

EFFECT AND ENFORCEMENT OF CONSER-

VATION LAWS.

N Y Conserv Law sec 835 Art 15 secs 15.17-15.19 (McKinney Supp 1968).

Descriptors: *New York, Civil law, *Legislation, State governments, *Conservation, Political

Water Law and Institutions—Group 6E

aspects, Riparian rights, Administrative agencies, Regulation, Legal aspects. Identifiers: *Fines, Tort liability.

These sections provide for fines to be levied upon violators of the state's conservation laws if the specific section violated does not do so itself. Such fines, if levied, may be recovered by the conservation commission in its own name in any court of competent jurisdiction. The conservation commission shall incur tort liability for the negligent acts or omissions of its agents, officers, and employees only to the extent prescribed by law with respect to agents, officers, and employees of the United States. The conservation act shall not be construed as affecting or in any way interfering with existing law with respect to riparian rights. (Scott-Fla) W69-03464

UNAPPROPRIATED STATE LANDS DEFINED.

NY Pub Lands Law sec 30 (McKinney 1951).

Descriptors: *New York, *Legislation, *State governments, *Land tenure, Canals, Administrative agencies, Political aspects, Civil law, Land classification, Legal aspects, Real property, Beds. Identifiers: Unappropriated state land, Abandonment.

This section defines the term 'unappropriated state lands' as meaning all state lands belonging to the common school fund, all escheated lands, all lands conveyed to the state for the benefit of the canal fund and not devoted in pursuance of law to any public use, all lands purchased by and for the state on the foreclosure of any mortgage given or loan of any federal or state funds, all state lands lying within the limits of any municipality not devoted to a public use, and all other lands owned by the state which are not directed by law to be kept for or applied to any specific purpose, except lands under water and abandoned canal lands, the disposition of which is prescribed elsewhere, and the lands disposed of under the salt springs law. The head of state departments having custody or jurisdiction over any state lands may abandon them by filing a written declaration of abandonment. When such declaration is approved by the board of commissioners of the land office, such abandoned lands shall become unappropriated state lands, unless constitutionally prohibited. (Scott-Fla) W69-03465

LUMBER OR BOATS FOUND ADRIFT.

N J Stat Ann secs 2A:44-53--2A:44-56 (1968).

Descriptors: *New Jersey, *Water law, *Boats, *Aquatic drift, Legislation, Lumber, Rivers, Drift-

Any person taking up drift lumber, rails, posts, boats, scows, skiffs, or barges, which are found adrift in any of the rivers or other waters of the State of New Jersey, may demand of and recover from the owner full compensation for his expense and labor. Amounts such as \$.12 per log are then listed as constituting full compensation. The person finding the drift lumber or craft must follow the procedures outlined in order to collect. He must procedures outlined in order to collect. He must first keep the lumber or craft for 6 days within 20 yards from the margin of the river where it was found. If the value of the lumber or craft is less than \$5 he must keep it for 90 days, and then he can appropriate it for himself if no one has claimed it. If the value exceeds \$5 the finder must advertise for six weeks. If no one has claimed the lumber or craft after six weeks the finder may sell it at public aucarter aix weeks the finder may sell it at public auction and subtract his compensation and expenses from the proceeds. The remainder of the selling price is held in trust by the finder for the owner for one year. After one year the finder becomes the legal owner of the proceeds of the sale. The taking of lumber or craft adrift without complying with this statute is a criminal offense. (Watson-Fla) W69-03474

SIRACO V VILLAGE OF WHITEHALL (NON-LIABILITY OF VILLAGE FOR FIRE DAMAGE RESULTING FROM VILLAGE'S FAULTY WATER SYSTEM). 5 A D 2d 925, 171 NYS 2d 1003-1004 (S Ct 1958).

Descriptors: *New York, Cities, Legislation, *Public utilities, Water law, *Water supply, Water contract, *Burning, Legal aspects, Water utilization, Maintenance.

Plaintiffs sued Village alleging liability for fire losses to plaintiffs' buildings. It was claimed that the Village breached its statutory duty requiring it to keep its water system in proper maintenance. As a result of the failure of the water system, the defendant was unable to extinguish a fire in plaintiffs' buildings. The court held that the Village had a data to maintain a water and fire system but that duty to maintain a water and fire system but that this duty did not carry with it any liability for breach. The court stated that municipalities have not been made insurers of loss by fire. (Graham-Fla) W69-03478

BERBERIAN V DOWD (ACCESS RIGHTS AND EASEMENTS ACROSS PRIVATE PROPERTY

247 A 2d 508-511 (RI 1968).

Descriptors: *Rhode Island, *Judicial decisions, *Easements, Legal aspects, Atlantic Ocean, Oceans, Right-of-way, Roads, Access routes, Real

Plaintiff brought an action to enjoin defendant from obstructing his use of a right-of-way easement which was included in a deed of land recently purchased by plaintiff. The easement guaranteed plaintiff access to the ocean along a strip of land which was only accessable from the public road, which was only accessable from the public road, however, by a dirt road on defendant's property. Defendant erected a fence across the road. Plaintiff claims an easement over defendant's property leading to the ocean. The court held that plaintiff failed to show clear and satisfactory evidence of an exist-ing easement. Notice was taken of a previous equity proceeding which permanently restrained the grantor of the strip of land easement from conveying any right to cross to defendant's road. (Holt-W69-03480

NATIONAL JURISDICTION AND THE USE OF

THE SEA,
Commission on Marine Science, Engineering and Resources, Washington, D. C. For primary bibliographic entry see Field 06B. For abstract, see . W69-03572

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,

For primary bibliographic entry see Field 06B. For abstract, see . W69-03583

HABEAS MARINUS: DUE PROCESS OF INNER-SPACE - A PROPOSAL, Miami Univ., Coral Gables, Fla. School of Law.

Louis Kutner.
Miami Univ Law Rev, Vol 22, No 3, pp 629-673,
Spring 1968. 45 p, 224 ref.

Descriptors: *Continental shelf, *International treaties, *International commissions, *International law, Mineralogy, Oil, Natural resources, International waters, Fishing, Foreign waters, Oceans, Technology, Jurisdiction, Exploitation, Water law, Law of the sea, Beds. Identifiers: Sea-bed, Aquaculture.

Scientific and technological progress permits ex-ploitation of the vast wealth under the seas. Sub-marine competition is not yet an issue among na-tions, although most states claim exlusive rights to

the continental shelf contiguous to their coastline. The convention on the Continental Shelf has been adopted by some states to prevent conflict and provide for cooperation in the development of under-seas recources. However, the convention merely lays down general principles, and for it to have meaningful application, there must be recourse to an international tribunal. Such a tribunal in cases where an individual's freedom to use the seas is denied by a nation claiming exclusive rights to that part of the seas, would be impowered to issue a writ of Habeas Marinus, a close relation to the writ of World Habeas Corpus. This writ would give the tribunal jurisdiction, and the conflict would be resolved on grounds of due process - whether the infringement upon the nation claiming exclusive rights was reasonable. The writ could also be used to fill in present gaps regarding jurisdiction over acts committed on the high seas. (Hoffman-Fla) W69-03588

INTERGOVERNMENTAL RELATIONSHIPS IN ADMINISTRATION OF RESOURCES,

Illinois Univ., Urbana. Dept. of Agricultural **Economics**

Norman G. P. Krausz.

Excerpted from WRC Research Report No. 18 (W69-03590). Water Resources Center, Summary Report, Sept 1968. 37 p. OWRR Project B-009-

Descriptors: *Jurisdiction, *Institutions, *Governments, *Planning, Control, Regulation, Inter-agency cooperation, Coordination, Attitudes, Water law, Administration, Cities water supply, Sewage treatment, Personnel, Flood control, Drainage, Soil treatment, Personnel, Flood control, Drainage, soil conservation, Water conservation, Recreation, Navigation, Water pollution, Financing, Federal administrative agencies, Income, State administrative agencies, Federal-state jurisdiction.

A survey of 583 governmental bodies responsible for wate resources, and a study of 65 federal and state water use statutes are the basis of this report. All levels of governmental bodies show considerable dissatisfaction with the present water administration system. A need is felt for more state and local action and a structural consolidation at the local level. Larger representative agencies are required, together with planning and consolidation on a regional basis with the state playing a unifying role. The effect of recent federal water laws is to provide assisting funds to state and local agencies. and to provide standards and criteria. Federal law requires little communication between federal requires little communication between federal water law agencies, and state agencies are largely uncoordinated and unregulated, and have small boundaries unrelated to water factors. The personnel that the agencies have are qualified, but the agencies are not fully staffed because the low pay scale and lack of funds. Federal grants to states are conditioned upon a particular need and are not continuous. The states must undertake new financial responsibility and appropriate funds for their water needs. (Hoffman-Fla) W69-03589

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,

Illinois Univ., Urbana. Dept. of Agricultural Economics.

Norman G. P. Krausz.

For condensed version see Summary Report (W69-03589). Water Resources Center, Research Report No 18, Sept 1968. 336 p. OWRR Project B-009-

Descriptors: *Jurisdiction, *Institutions, *Governments, *Planning, Control, Regulation, Inter-agency corporation, Attitudes, Coordination.

Data for this report was obtained from 65 Federal and State laws, 73 conferences with government officials, and 583 survey questionnaires completed by officials of governmental units. Water resource

Group 6E—Water Law and Institutions

functions studied were soil and water conservation, sewage treatment, flood control, drainage, water supply, recreation and navigation. Significant dissatisfaction was found with the current structure and performance of the water system. The primary concern is for more State and local action and structural consolidation for more effective administration. The superimposition of Federal law and funds has been catalytic but also disruptive of rela-tionships within the State. A State Water Code is needed to establish an orderly system of administration and to channel the Federal effort into a coordinated scheme of assistance and encouragement without detracting from its vitality or neglecting the standards and criteria imposed. Generally there is an external communication gap and a failure to recognize the interrlationships of water functions. A more formal and patterned system of communication should be established for all water related functional systems. (Heckerling-Fla) W69-03590

COMPREHENSIVE RIVER BASIN PLANNING: THE ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE EXPERIENCE.

Michigan Univ., Ann Arbor. Inst. of Public Ad-

For primary bibliographic entry see Field 06B. For abstract, see . W69-03596

SOME CRITICAL PROBLEMS OF THE SHELL-FISH INDUSTRY.

J. A. Carver, Jr.

National Shellfisheries Association, Proceedings, Vol 56, May, 1966, pp 9-12.

Descriptors: *Commercial shellfish, *Efficiencies, Descriptors: *Commercial shelmsn, *Ethiciencies, *Competition, *Legislation, *Technology, *Water policy, Economic efficiency, Fish management, Competing uses, Water utilization, Productivity, Management, Fisheries, Commercial fishing, Methodology, Industries, Industrial production, Water resources, Resources, Water management, Administration, Regulation, Water law, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellf-

Technological inefficiency as well as outdated legislation are seen as critical problems of the shellregistation are seen as critical problems of the analysis in the state of the author states that technological inefficiency leads to an unfavorable competitive position. Conflicts between the shellfish industry and other uses of the water resource are discussed.
W69-03621

THE POLITICS OF BEAUTY,

Henry L. Diamond.

Parks and Recreation, February, 1966, pp 138-

Descriptors: *Aesthetics, *Governments, *Water pollution, *Urban renewal, Air pollution.

The author notes that all factions of society are becoming concerned about the quality of the country as well as the quantity of its gross national country as well as the quantity of its gross national product. Such issues as air and water pollution and urban blight are receiving widespread attention from legislature and citizenry. If the citizen wants government to represent his interests, however, he must involve himself in politics. Two things are necessary for this involvement: (1) effective organization, and (2) information on issues. W69-03648

FEDERAL COURT DECISION JEOPARDIZES CURRENT EFFORTS TO SAFEGUARD NA-TION'S ESTUARIES.

For primary bibliographic entry see Field 02L.
For abstract, see. W69-03663

ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF HEMPSTEAD, N.Y. For primary bibliographic entry see Field 04A. For abstract, see . W69-03665

HOW TO STOP THE PILLAGE OF AMERICA,

Sports Illustrated, Vol 27, No 24, December 11, 1967, pp 40-53.

Descriptors: *Thermal pollution, *Wetlands, *Conservation, *Legislation, Natural resources, Resources, Water pollution.

The author argues strongly for increased federal legislation to protect U. S. natural resources. He particularly urges Congressional legislation on thermal pollution and the protection of coastal estuaries and wetlands.

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND TRIBUTARIES IN MARION AND POLK COUNTIES, OREGON, Corps of Engineers, Portland, Oreg. For primary bibliographic entry see Field 02E. For abstract, see . W69-03539

LIMITING FACTORS IN HARBOR DEVELOP-MENT, William F. Cassidy.

Paper presented to the Tanker Conference of the American Petroleum Institute, May 10, 1966.

Descriptors: *Oil industry, *Competing uses, *Harbors, Channel improvement, Navigation, Industries, Transportation, Efficiencies, Water utiliza-

General Cassidy maintains that the limit to channel and harbor deepening has been reached and urges the oil companies to seek alternatives for low cost shipping other than continued construction of several-hundred-thousand-ton tankers. Joint offshore pipeline loading facilities are one suggested solution. Port use conflicts are listed. W69-03622

6G. Ecologic Impact of Water Development

A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES, G. W. Allen.

19th Annual Session Gulf and Caribbean Fisheries Institute (1966), Proceedings, September, 1967,

Descriptors: *Aquatic productivity, *Direct benefits, *Ecology, *Environmental effects, Marine fisheries, Channel flow, Stream flow, Balance of nature, Real property, Industrial wastes, Mississippi River, Indirect benefits, Benefits, Productivity, Thermal pollution, Fisheries, Water pollution, Alteration of flow, Flow, Wastes, Surface waters, Streams, Running waters, Rivers, Interstate waters, Bodies of water, Encroachment, Saline water intrusion. water intrusion.

The author argues that no man-made changes in estuaries benefit estuarine production and that, in most cases, they harm it. He feels that these changes can come about in one of four ways: (1) channel and stream flow diversion, (2) industrial filling and encroachment, (3) pollution of all sorts, and (4) real estate development. It is stated that there is a point where the benefit ratio does not equal estuarine value, and that the value of estuarine value, and that the value of estuarine value, and that the value of estuarine value is the stream of the value of estuarine value, and that the value of estuarine value, and that the value of estuarine value, and that the value of estuarine value is the value of estuarine value, and that the value of estuarine value is the value of estuarine value, and that the value of estuarine value is the value of estuarine value.

ries will increase in direct proportion to their destruction by so-called improvements. The author feels that point has been reached.

W69-03607

THE ROLE OF MAN IN ESTUARINE PROCES-

American Association for the Advancement of Science, Washington, D. C. Eugene Cronin.

In ESTUARIES, No 83, 1967, pp 667-686.

Descriptors: *Management, *Social aspects, Resource allocation, Florida, Atlantic coastal plain, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S., Louisiana, Foreign countries.

The effects of civilization on estuarine processes are described. The study is divided into three major phases: (1) The physical, chemical, and biological phases: (1) The physical, chemical, and biological processes which are unusually significant in the estuary and which might be modified by man. (2) How human activities have affected these processes beyond the normal range of variation present in the virgin estuary. (3) The possibilities for future management of estuarine processes for optimal achievement of human values from estuaries. Among specific examples cited are: Tampa Bay (Florida), Lake Pontchartrain (Louisiana), Chesapeake Bay, and The Zuiderzee (Netherlands). lands) W69-03638

ECONOMIC IMPACT OF UNITED

STATES OCEAN PORTS.
Report, Maritime Administration, U. S. Department of Commerce, Washington, D. C., 1966.

Descriptors: *Harbors, *Employment, *Transportation, *Economic impact, Ships, Channel improvements, Value, Income, Return (Monetary), Expenditures.

The study is the first of its kind in an attempt to portray the value of the port to the economic growth of the port community and its tributary territory. There are two tables presented in this publication. One table contains the information, by each individual port, on domestic employment attributa-ble to U. S. export, the freight traffic and direct dollar value of cargo earnings for each port area. In addition, the table shows the passenger traffic of each port, as well as the total number of vessels passing through the port. Another table presents data pertinent to ports and states relative to port development expenditures, by type of terminal, between 1946 and 1962, total Federal funds expended on port channel improvements up to 1963, the cash value of port facilities, and the proposed Federal channel improvement expenditures for 1965. W69-03654

'ASPECTS OF THE ESTUARINE ECOSYSTEM'. National Security Industrial Association, Washing-

National Security Industrial Association, Washington, D. C.
Joel W. Hedgpeth.
In MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES, Ocean Resources Subcommittee Meeting, December 13, 1967.

Descriptors: *Balance of nature, *Ecosystems, River flow, Water pollution effects, Channel flow, Water pollution, Environmental effects, Mollusks, Aquatic life, Invertebrates, Benthic fauna, Benthos, Flow, Estuarine environment, Aquatic environment, Environment.

Among the characteristics of the estuarine ecosystem are the occurrence of closely related species adjusted to the seasonal and nutrient cycles of the estuary, the seasonal replacement of various mass species, and the integrating effect induced by large populations of benthic mollusks, especially

oysters and mussels. It is suggested that such a value as gross photosynthesis is not a good indicator in itself of the state of this complex system. Factors causing the decline of productivity and ecological health of several major estuarine ecosystems are discussed; these declines are primarily due to such works of man as alteration of river flow, changing shorelines by filling, and pollution.

W69-03677

THE OYSTER AND THE DREDGE OR 'BEAU-TY AND THE BEAST', John W. Huston.

World Dredging and Marine Construction, Vol 4, No 2, March 1968, pp 30-31.

Descriptors: *Oysters, *Dredging, *Ecology, Aquatic habitats, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Commercial shellfish, Invertebrates, Marine animals, Habitats, Environment, Mollusks, Shellfish, Silting, Sedimentation, Toxicity, Turbidity, Physical properties, Life cycles, Physiological ecology.

The author refutes complaints made by oyster fishermen on the effects of dredging on oyster beds. Points covered are: toxicity, chemical changes, turbidity, effect on life cycle, siltation, and physiological irritation. W69-03680

'STATEMENT',
Federal Water Pollution Control Administration. Atlanta, Ga.

For primary bibliographic entry see Field 02L. For abstract, see. W69-03696

07. RESOURCES DATA

7A. Network Design

MODERN HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN RUMANIA (IN RUMANIAN).

National Council of Engineers and Technical Scientists, Bucharest (Rumania).

For primary bibliographic entry see Field 06B.

For abstract, see. W69-03314

ON RESERVOIR NETWORKS,

For primary bibliographic entry see Field 04A. For abstract, see. W69-03378

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS, Florida Univ., Gainesville. Dept. of Environmental

Engineering.
J. C. Schaake, Jr.

ASCE Tech Mem No 3, Urban Water Resources Res Program, Aug 1968. 57 p, 10 fig, 15 tab, 8 ref. USGS: 14-01-0001-1585.

Descriptors: *Optimization, *Mathematical studies, *Economic feasibility, *Data processing, *Rainfall-runoff relationships, Urbanization, Stream gages, Rain gages, Data collections, Hyetographs, Hydrographs, Statistical methods,

graphs, Hydrographs, Statistical methods, Stochastic processes. Identifiers: *Urban hydrology, Spectral analysis, Data network response.

The characteristics of rainfall-runoff data and instrumental response are analyzed in a cost-effectiveness study of urban hydrology data-collection systems. Rainfall data characteristics are subdivided into rainfall measurement error, measurement criteria, and response of tipping bucket rain gages. A stochastic model of rainfall is used to pregages. A stochastic model of rainfall is used to pre-dict rain-gage network response. Coefficients of variation of the ratio of measured intensity to average intensity at several operating gages in the Baltimore area are tabulated. The best urban runoff gaging system uses Parshall flumes. Measurement errors are analyzed and data from Northwood, a well-instrumented area in Baltimore, are tabulated and discussed. Rainfall and runoff data are analyzed by regression and spectral analyses, and shown by hyetographs and hydrographs. Water quality measuring and sampling systems are discussed and analyzed for optimum design. Economic and operations research approaches are outlined and recommended for op-timization of urban hydrologic data systems. (Knapp-USGS) W69-03509

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION RESOURCES,

Illinois Univ., Urbana. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 06E. For abstract, see . W69-03589

7B. Data Acquisition

SHORTCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS, Geological Survey, Washington, D. C.

Ray Bentall. U S Geol Surv Water-Supply Pap No 1545-C, 1963. 117 p, 31 fig, 4 plate, 17 tab, 27 ref.

Descriptors: *Test procedures, *Aquifer characteristics, *Drawdown, Well spacing, Artesian wells, Mathematical studies, Groundwater.

Identifiers: *Discharging wells, Nonequilibrium

Seventeen specific problems in aquifer testing are illustrated by pertinent graphics and equations. Shortcuts cover such areas as: composite type curve for analyzing aquifer-test data; chart for computating drawdowns near a discharging well; slide rule to solve groundwater problems by nonequilibrium formula; application of nonequilibrium formula to groundwater problems; a simplified time- and distance-drawdown graph; storage coefficient determined from straight-line storage coefficient determined from straight-line storage coefficient determined from straight-line plots without extrapolation; special drawdown scales for predicting water-level changes in heavily pumped areas; type curves relating to single-boundary problems and nonsteady radial flow in an infinite leaky arterian aquifer; drawdown patterns in aquifers with straight-line boundary; the cone of depression and area of diversion around a discharging well in an infinite strip aquifer subject to uniform recharge; percentage of pumped water diverted; locus circles to locate hydrogeologic boundary; well spacing. (Llaverias-USGS) W69-03231

USE OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,

Leo M. Page. Ground Water, J Tech Div Nat Water Well Ass, Vol 6, No 5, pp 31-40, Sept-Oct 1968. 10 p, 8 fig, 5

Descriptors: *Groundwater movement, *Resistivity, *Geophysics, *Flow nets, Artificial recharge, Water table, California, Observation wells. Identifiers: Electrical resistance surveys, Wenner configuration, Schlumberger configuration.

Electrical resistivity methods for groundwater investigations are described, and typical examples of resistivity survey data checked against test drilling and well tests in Santa Clara County, California, are presented. A table shows correlations of resistivity data and percolation rates. The advantages of resistivity surveys are low cost, ease of operation, speed, and accuracy. The Wenner and

Schlumberger electrode configurations are used. Flow nets were constructed with resistivity, test hole, and well survey data to evaluate artificial recharge and water spreading projects. (Knapp-USGS) W69-03235

SOME STATISTICAL TOOLS IN HYDROLOGY, Geological Survey, Washington, D. C. H. C. Riggs.

Geol Surv Tech Water-Resources Invest, Book 4, Chapter A1, 1968. 39 p, 26 fig, 5 tab, 27 ref.

Descriptors: *Statistical methods, *Hydrologic data, Correlation analysis, Regression analysis, Digital computers, Hydrology, Analysis. Identifiers: Technical manuals, Multivariate analysis, Variance, Covariance.

Background material needed for understanding the statistical procedures most useful in hydrology is given in detail. Detailed procedures, with examples, of regression analyses are presented. The analysis of variance and of convariance is described. The characteristics of hydrologic data and their statistical treatment are discussed. (Knapp-USGS) W69-03344

MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT METHODS, Geological Survey, Washington, D. C. G. L. Bodhaine.

Geol Surv Tech Water-Resources Invest, Book 3, Chapter A3, 1968. 60p, 32 fig, 7 tab, 16 ref.

Descriptors: *Discharge measurement, *Peak discharge, *Stage-discharge relations, *Culverts, Control, Energy equation, Continuity equation. Identifiers: Technical manuals, Indirect discharge measurements, Culvert flow.

U S Geological Survey methods for measurements U S Geological Survey methods for measurements of peak discharge at culverts are given. Culvert flow is classified into 6 types, discharge equations based on continuity and energy equations are given, and field procedures for measuring peak discharge using culverts are described. Discharge coefficients for a variety of culvert geometries and flow types are tabulated. Step-by-step computation procedures are given in detail in 10 examples. (K-napp-USCS) napp-USGS) W69-03345

GENERAL PROCEDURE FOR GAGING STREAMS,

Geological Survey, Washington, D. C. R. W. Carter, and Jacob Davidian. Geol Surv Tech Water-Resources Invest, Book 3, Chapter A6, 13p, 10 fig, 5 ref.

Descriptors: *Stream gages, *Control, Current meters, Discharge measurement, Gaging stations, Water levels, Stage-discharge relations. Identifiers: Technical manuals, Stream gaging, Rat-

The objectives and procedures used in obtaining streamflow records are briefly described in an introduction to other more detailed chapters on stream gaging in the USGS series of technical manuals for water resources investigations. The topics surveyed are gaging site selection, artificial controls, stage measurement, discharge measurement, d ment, discharge ratings, computation and prepara-tion of discharge records, and publication of records. (Knapp-USGS) W69-03346

WATER INTERAGENCY RESEARCH AND DATA COLLECTION PRO-

Wisconsin Dept. of Natural Resources, Madison, and Wisconsin Univ., Madison.
For primary bibliographic entry see Field 09D.

For abstract, see.

Field 07—RESOURCES DATA

Group 7B—Data Acquisition

W69-03360

STREAMFLOW AND PRECIPITATION DATA INDEX.

For primary bibliographic entry see Field 04A. For abstract, see. W69-03380

VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES

Southeastern Forest Experiment Station, Franklin,

For primary bibliographic entry see Field 02G. For abstract, see . W69-03394

NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND DATA,

American Society of Civil Engineers Program Office, Cambridge, Mass.

For primary bibliographic entry see Field 02E. For abstract, see .

W69-03507

OAKDALE GAGING INSTALLATIO CHICAGO-INSTRUMENTATION AND DATA INSTALLATION.

American Society of Civil Engineers Program Office, Cambridge, Mass. For primary bibliographic entry see Field 02E. For abstract, see . W69-03508

A CRITICAL REVIEW OF METHODS OF MEA-SURING DISCHARGE WITHIN A SEWER PIPE,

Illinois Univ., Urbana. H. G. Wenzel, Jr.

ASCE Tech Mem No 4, Urban Water Resources Res Program, Sept 1968. 20 p, 2 fig, 2 append. USGS: 14-08-0001-11257.

Descriptors: *Stream gages, *Flow measurement, *Flowmeters, *Closed conduit flow, *Sewers, Venturi meters, Tracers, Radioactivity techniques, Dyes releases, Tracking techniques, Research and

development.
Identifiers: Rating curves, Urban hydrology.

Existing methods of measuring discharge of sewers are discussed with respect to the requirements and physical limitations imposed by their use in an urban study area, and rating curves for a suggested urban study area, and rating curves for a suggested critical flow device are presented with recommendations for future research. The gage must have an output in the form of an electrical signal for recording, be automatically turned on and off, and need no attendant. Laboratory velocity probes are unsuitable because of clogging problems. Desired accuracy is 5% in discharge measurement over a large flow range. The device must be capable of installation in any existing sever at reasonable cost. Wairs tion in any existing sewer at reasonable cost. Weirs, depth gages, and velocity meters, the methods presently available, all have serious disadvantages and are not recommended. Tracer dilution methods as well as Venturi flumes and other critimethods as well as Venturi flumes and other criti-cal flow devices are suggested for development. A pipe section with a narrow throat acts as a Venturi flume for open flow and as a Venturi meter for full flow. Plans and theoretical rating curves for such a device are shown. (Knapp-USGS) W69-03510

METHODS OF MEASURING WATER LEVELS IN DEEP WELLS, Geological Survey, Washington, D. C. M. S. Garber, and F. C. Koopman. Geol Surv Tech Water-Resources Invest, Book 8, Chapter A1, 1968.

Descriptors: *Water levels, *Instrumentation, *Deep wells, Water wells, Piezometers, Measurement, Equipment.
Identifiers: Technical manuals, Deep well measure-

Deep well water level measurement devices and techniques are described. Accurate measurement of water levels deeper than 1,000 feet in wells requires specialized equipment. Corrections for stretch and thermal expansion of measuring tapes must be considered, and other measuring devices must be calibrated periodically. Borehole deviation corrections also must be made. Devices for recording fluctuation of fluid level usually require mechanical modification for use at these depths. A multichannel recording device utilizing pressure transducers has been constructed. This device was originally designed to record aquifer response to nearby underground nuclear explosions but can also be used for recording data from muti-well pumping tests. Bottom-hole recording devices designed for oil-field use have been utilized in a designed for oil-field use have been utilized in a limited manner. These devices were generally found to lack the precision required in ground-water investigations at the Nevada Test Site but may be applicable in other areas. A newly developed bottom-hole recording pressure gauge of improved accuracy has been used with satisfactory results. (USGS) W69-03535

CALIBRATION AND MAINTENANCE OF VER-

TICAL-AXIS TYPE CURRENT METERS, Geological Survey, Washington, D. C. George F. Smoot, and Charles E. Novak. Geol Surv Tech Water-Resources Invest, Book 8, Chapter B2, 1968. 15 p, 5 fig, 1 tab, 3 ref.

Descriptors: *Current meters, *Instrumentation, *Calibrations, *Maintenance, Rotating meters,

Identifiers: Technical manuals, Vertical axis current meters, Meter rating.

The procedures used in the manufacture and calibration of current meters are described and information pertinent to their proper maintenance and repair is presented. Recent intensive studies on the calibration of current meters and the effects of wear of the component parts on the performance of the meters have led to the adoption of new procedures for the manufacture, calibration, maintenance, and repair of meters. This chapter, theretenance, and repair of meters. This chapter, therefore, updates the provisional manual 'Care and Rating of Current Meters' (1957) by including these new procedures. (USGS) W69-03536

CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,

International Atomic Energy Agency, Vienna

(Austra).
T. Dincer, T. Florkowski, and E. Halevy.
For 8-Volume Proceedings, see this issue, Field
06B, W69-03305. Int Conf on Water for Peace,
Wash, D.C., Vol 4, pp 332-341, 1967. 10 p, 30 ref.

Descriptors: *Tracers, *Radioisotopes, *Data collections, Path of pollutants, Groundwater movement, Streamflow, Sediment transport, Tracking techniques, Methodology, Safety factors.

Techniques in using artificial radioactive sources are described as well as their advantages and disadvantages and their role in water resources investigations. Radioactive tracers have been used for many years in measurement of stream discharge, determination of direction and rate of grounwater flow, tracing sediment transport in streams and estuaries, and in tracing movement of contaminants in ground and surface waters. Radioactive tracers offer great advantages in terms of distinct identification and precise measurement of the tracer. However, these advantages are offset to some extent by the need to observe rigid safety precautions and the need for cumbersome equipment. Radioactive tracers, therefore, have been limited to special uses where conventional hydrologic approaches are unsuitable. (USGS) W69-03544

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION RESOURCES. OF

Illinois Univ., Urbana. Dept. of Agricultural For primary bibliographic entry see Field 06E.

For abstract, see . W69-03589

INFRARED IMAGES OF THE KAU AND PUNA

INFRARED IMAGES OF THE KAU AND PUNA COASTLINES ON HAWAII, Hawii Univ., Honolulu. William M. Adams, and Larry K. Lepley. Hawaii Water Resources Research Center, Tech Rpt. No 26, Dec 1968. 51 p, 9 fig, 7 ref. OWRR Project B-008-HI.

Descriptors: Coastlines, Infrared scanner, Puna, Kau, Hawaii, Mosiac, Images.

An infrared scanner has been flown over the coast-line of the Puna and Kau Districts on the island of Hawaii using an Apache aircraft. The images were monitored in real time and selectively photographed. The flightline was made at an altitude from 10 to 11,000 feet. Each image represents a ground area about 1,000 feet on a side. The films of the images taken have been processed and catalogued. A few areas of special importance have had the images correlated into a mosaic to aid interpretation. The equipment used, the field procedures fol-lowed, and an index to the catalogued films are presented in this report. The image quality is illustrated by a few frames and mosaics. The procedure of obtaining infrared imagery is rather complex when taken in its entirety and much practice is necessary to achieve high-quality images. The greatest difficulty encountered was the high-level flightline required by a narrow angle lens on the scanner. At the time this study was made no wide-angle lens was available. At present, a wide angle lens is available. Any future surveys will use a wide angle lens to avoid the difficulties encountered because of the altitude. W69-03600

7C. Evaluation, Processing **AND Publication**

FUNDAMENTALS OF HYDROLOGIC FORECASTING,

For primary bibliographic entry see Field 02E. For abstract, see. W69-03218

MONTHLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY, Geological Survey, Washington, D. C. For primary bibliographic entry see Field 02E. For abstract, see .

OPTIMIZATION TECHNIC HYDROLOGIC ENGINEERING, **TECHNIQUES**

Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03329

LINEAR ANALYSIS OF HYDROGRAPHS,

Geological Survey, Champaign, Ill. William D. Mitchell.

Water Resources Res, Vol 3, No 3, pp 891-895, 1967. 5 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Hydrograph analysis, *Hydrographs, *Unit hydrographs, *Rainfall-runoff relationships, Storage, Routing, Flood routing, Streamflow Storage, Routing, Flood routing, Calonia forecasting, Identifiers: Linear hydrograph, Linear analysis.

A linear hydrograph is described by the values of 5 parameters: the size of the drainage area, the

amount of rainfall excess, the duration of rainfall excess, the translation time, and a storage index. The unit hydrographs and other linear flood hydrographs may be computed by incorporating the values of the 5 parameters into a generalized dimensionless model hydrograph, using published tabulated model hydrograph values. Model hydrographs are dimensionless representations of the instantaneous translation hydrograph.

ELECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS APPLICATION TO UNCONFINED AQUIFERS,

Geological Survey, Washington, D. C.

Geol Surv Water-Supply Pap 1536-H, pp 205-242, 1963. 37 p, 16 fig, 5 tab, 12 ref.

Descriptors: *Analog models, *Groundwater movement, *Water level fluctuations, Water wells, Discharge (Water), Permeability, Porosity, Aquifers, Specific yield, Anisotropy, Drawdown, Hydrographs, Analytical techniques. Identifiers: *Pumping test analysis, *Flow equa-

Electric-analog design criteria are established from the differential equations of groundwater flow for analyzing pumping-test data. A convenient analog design was obtained by transforming the cylindrical equation of flow to a recti-linear form. The design criteria were applied in the construction of an electric analog, which was used for studying pumping-test data collected near Grand Island, Nebraska. Data analysis indicated (1) vertical flow com-ponents near pumping wells in unconfined aquifers may be much more significant in the control of water-table decline than radial flow components for as much as a day of pumping; (2) the specific yield during the first few minutes of pumping ap-pears to be a very small fraction of that observed after pumping for more than 1 day; and (3) estimates of specific yield made from model studies seem much more sensitive to variations in assumed flow conditions than are estimates of permeability. Analysis of pumping-test data where vertical flow components are important requires that the degree of anisotropy be known. A procedure for computing anisotropy directly from drawdowns observed at five points was developed. Results obtained in the analog study emphasize the futility of calculating unconfined aquifer properties from pumping tests of short duration by means of equations based on the assumptions that vertical flow components are negligible and specific yield is constant. (USGS)
W69-03356

STREAMFLOW DATA PROCESSING OPPOR-TUNITIES AND APPLICATION, Southeastern Forest Experiment Station, Franklin,

A. R. Hibbert, and G. B. Cunningham.

Reprint from Proc. Int. Symp. Forest Hydrol., Penn State Univ 1965, 725-736, Pergamon Press, Inc.

Descriptors: *Analog computers, *Data processing, *Computer programs, *Hydrologic data, Streamflow, Electronic equipment, Digital computers, Computers. Identifiers: *Hydrologic analysis.

The techniques used at the Coweeta Hydrologic Laboratory for processing streamflow records from recorder charts and analog-to-digital recorder tapes to final discharge integration are discussed in detail. A computer method is presented for separating the stream hydrograph into parameters useful for evaluation and comparisons of streamflow response. Costs of equipment and data processing are also given.

W69-03389

FINITE DIFFERENCING METHODS,

Agricultural Research Service, Beltsville, Md. Hydrograph Lab. D. L. Brakensiek.

Water Resources Res, Vol 3, No 3, pp 847-860, 1967. 14 p, 3 fig, 4 illus, 12 tab, 17 ref.

Descriptors: *Digital computers, *Hydrology, *Computer programs, *Numerical analysis, *Approximation method.

Identifiers: *Finite differencing methods, Finite calculus, Partial differential equations.

Today analytical techniques, numerical algorithms, and computation facilities have made it possible to solve many hydrologic problems. The emphasis on numerical solutions requires that the hydrologist have some basic knowledge of numerical methods, that is, the calculus of finite differences. Flow of water in its various phases comprises a large part of hydrologic studies. These processes described by partial differential equations (generally nonlinear) require finite difference approximations for tracta-ble computations. Considerations of convergence, order of approximation, and stability of these difference quotients again require some background in finite difference methods. Through brief discus-sions, several examples, and a list of references, some of the above considerations are introduced. W69-03519

TIME SERIES ANALYSIS,

Geological Survey, Arlington, Va. For primary bibliographic entry see Field 06A. For abstract, see . W69-03524

VARIANCE SPECTRUM ANALYSIS,

National Center for Atmospheric Research, Boulder, Colo. For primary bibliographic entry see Field 06A. For abstract, see . W69-03525

DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS: A COMPUTER SIMULA-

TION MODEL,
Stanford Univ., Calif. Dept. of Geology; and Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03542

AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS, Geological Survey, Cheyenne, Wyo. James F. Wilson, Jr. Geol Surv Res 1968, Prof Pap 600-D, pp D54-D56,

1968. 3 p, 1 fig, 2 ref.

Descriptors: *Tracers, *Dye releases, *Velocity, Streamflow, Stream gages, Discharge measure-

Identifiers: Empirical methods, Dye requirements, Time-of-travel measurements.

Data from time-of-travel measurements in a wide variety of streams are used empirically to relate the amount of rhodamine B dye required for slug injections to the volume of flowing water in a stream reach. The formula requires slight modification for low-flow or low-velocity measurements, or for use with Rhodamine WT, a newer dye for which sufficient field data are not yet available. (USGS) W69-03565 Data from time-of-travel measurements in a wide

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,

Illinois Univ., Urbana. Dept. of Agricultural

For primary bibliographic entry see Field 06E. For abstract, see . W69-03589

SIMULATION OF A WATER RESOURCES SYSTEM.

Washington Univ., Seattle. Fisheries Research Inst. For primary bibliographic entry see Field 06A. For abstract, see. W69-03601

08. ENGINEERING WORKS

8A. Structures

WATER FRONT IMPROVEMENTS.

For primary bibliographic entry see Field 06E. For abstract, see W69-03413

WATER POWER COMPANIES ALONG TRIBUTARIES TO BARNEGAT BAY. For primary bibliographic entry see Field 06E.

For abstract, see . W69-03417

BEACH FRONT REPAIR AND DREDGING OF STREAMS.

For primary bibliographic entry see Field 06E. For abstract, see . W69-03422

HURRICANE DAMAGE TO STRUCTURES,

G. W. Cooper. Ocean Industry, Vol 2, No 10, October, 1967, pp

Descriptors: *Offshore platforms, *Hurricanes, *Damages, Ocean waves, Structures, Engineering structures, Hydraulic structures, Waves (Water), Storms, Tropical cyclones, Accidents.

These articles discuss various incidents of storm damage to offshore platforms and collision conflicts

W69-03634

POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA, For primary bibliographic entry see Field 04A.

For abstract, see . W69-03700

8B. Hydraulics

POTENTIAL FLOW AND SOIL STRUCTURE

CHANGES, Slovak Technical Univ., Bratislava

zechoslovakia) For primary bibliographic entry see Field 02F.

For abstract, see. W69-03203

A CRITICAL REVIEW OF METHODS OF MEA-SURING DISCHARGE WITHIN A SEWER PIPE, Illinois Univ., Urbana.

For primary bibliographic entry see Field 07B. For abstract, see . W69-03510

8D. Soil Mechanics

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF POLDERS IN THE YSSEL-LAKE.

Zuiderzee Polders Development and Colonization Authority, Zwolle, Netherlands, 1967.

Descriptors: *Land reclamation, *Soil mechanics, *Foreign countries, Coastal engineering, Drainage, Agricultural engineering, Engineering, Dredging, Geographical regions, Regions.

Field 08-ENGINEERING WORKS

Group 8D—Soil Mechanics

The economic significance of the reclamation works and the technical procedures of enclosure works and the technical procedures of enclosure and reclamation operations are briefly described. Among procedures described are dredging, polder drainage, and soil shifting. W69-03656

8E. Rock Mechanics AND Geology

ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING.

Oak Ridge National Lab., Oak Ridge, Tenn. Health

W. C. McClain.

Felsmechanik und Ingenieurgeol, J Int Soc Rock Mech, Vol 6, No 3, pp 139-161, 1968. 23 p, 11 fig, 2 tab. 16 ref.

Descriptors: *Waste disposal, *Injection wells, *Rock mechanics, *Fractures (Geology), Permeability, Porosity, Stress. Identifiers: *Hydraulic fracturing.

The ultimate capacity of a hydraulic-fracturing me ultimate capacity of a nydraulic-fracturing waste disposal facility is governed primarily by the integrity of the rocks overlying the injected wastes. The objective of the study was to analyze theoretically the stresses and strains generated by the injected wastes so that the failure mechanism could be predicted and the capacity of the injection well estimated. The surface uplifts at Oak Ridge Naestimated. The surface upints at Oak Ridge National Laboratory's fracturing site were compared with theoretical curves obtained by assuming the uplifts to be inversely analogous to the subsidence which occurs over mining excavations. The most probably mechanism of failure of the rock appears to be by the formation of a vertical instead of a horizontal fracture. Fracture orientation is controlled primarily by the orientation of the principal stress field in the rock. Each successive waste injec-tion slightly modifies this stress field toward a con-dition more favorable to the formation of a vertical dition more favorable to the formation of a vertical fracture. The effect of repeated injections was evaluated for various assumed original stresses and the minimum ultimate capacity of the formation was estimated as 4 million gal. It is also possible to make recommendations to avoid, as far as possible, the conditions leading to failure and in this way increase the formation capacity.

W69-03522

8I. Fisheries Engineering

PROHIBITED ACTS.

N Y Conservation Law sec 275 (McKinney 1968).

Descriptors: *New York, Legislation, Legal aspects, Dams, *Fish, Bass, Trout, Lake trout, Salmon, *Fish conservation, Fish reproduction, Explosives, Governments, Electric power production, Impoundments, *Impounded waters, Permits, Administrative agencies.

Section 275 prohibits the taking of fish by use of explosives or by shutting or drawing off water. Bass, trout, lake trout, and salmon may not be disturbed on their spawning beds during the closed season. No person may draw off water held back by a dam if it will result in the loss of a substantial number of fish in the impoundment. This provision does not apply to governments or electric power producers; it shall not apply in the event of an producers; it shall not apply in the event of an emergency or to artificial or man-made bodies of water lying wholly within the boundaries of privately owned or leased lands. (Sisserson-Fla) W69-03469

SAVE-THE-SALMON PROJECT ON THE ST. JOHN RIVER.

For primary bibliographic entry see Field 05C. For abstract, see W69-03669

09. MANPOWER, GRANTS, AND FACILITIES

9A. Education (Extramural)

EUTROPHICATION, isconsin Univ., Madison. Lab. of Limnology; and Wisconsin Univ., Madison. University-Industry Research Program. For primary bibliographic entry see Field 05C.

or abstract, see W69-03357

9D. Grants, Contracts, AND Research Act **Allotments**

INTERAGENCY WATER RESOURCES
RESEARCH AND DATA COLLECTION PRO-RESOURCES GRAM.

Wisconsin Dept. of Natural Resources, Madison; and Wisconsin Univ., Madison.

Published by: Water Resources Ctr, Univ of Wisconsin, Madison.

Descriptors: *Wisconsin, *Data collections, *Research and development, *Planning, Water quality, Water pollution, Geochemistry, Lake shores, Wetlands, Pesticides, Rivers, Fisheries, Water resources, Eutrophication, Simulation analysis, Invertebrates, River basins, Hydrology, Wild rivers. Ground water.

Wisconsin's Interagency Water Resources Research and Data Collection Program was established in 1966 by an act of the state legislature. During the program's 3-yr history, the participating agencies have developed a joint statewide program that focusses attention on a number of Wisconsin's water problems. Participating agencies include: Bureau of Research and Division of Environmental Protection, both of the Wisconsin Department of Natural Resources, and the Geological and Natural History Survey and Water Resources Center, both of The University of Wisconsin. Coordinated activities of these agencies helped pervent overlapping of effort while per-Resources Center, both of The University of Wisconsin. Coordinated activities of these agencies helped pervent overlapping of effort while permitting adequate coverage of selected topics. This publication includes short summaries of 36 projects supported under the program. Following titles selected from those included demonstrate the scope and diversity of the program: Trout Population Study in Relation to Organic Pollution; Evaluation of Lakeshore Development; Study of Removal of Nutrients, Detergents and Other Pollutional Materials by Sub-Surface Percolation; Research on Sewage Effluent Ponds; Movable Automatic Water Quality Monitoring; Survey of Pesticides in Benthic Invertebrates; Nitrate in Drinking Water Supplies; State-Wide Inventory of River Basins; Hydrology of a Wetland Area; Basin Hydrology of a Wetland Area; Basin Hydrology of a Wild River; Geological Aspects of Lake Eutrophication; Geochemical Prospecting by Spring-Sampling in Zinc Mining Area.

10. SCIENTIFIC AND TECHNICAL INFORMATION

A DIRECTORY OF INFORMATION RESOURCES IN THE UNITED STATES:

National Referral Center for Science an Technology, Washington, D. C., September, 1966

Descriptors: *Information retrieval, *Resources, *Bibliographies, Publications, Documentation

This document lists organizations performing research or collecting data on water or water-related subjects. It is concerned with fresh water--the field of oceanography has been included. W69-03650

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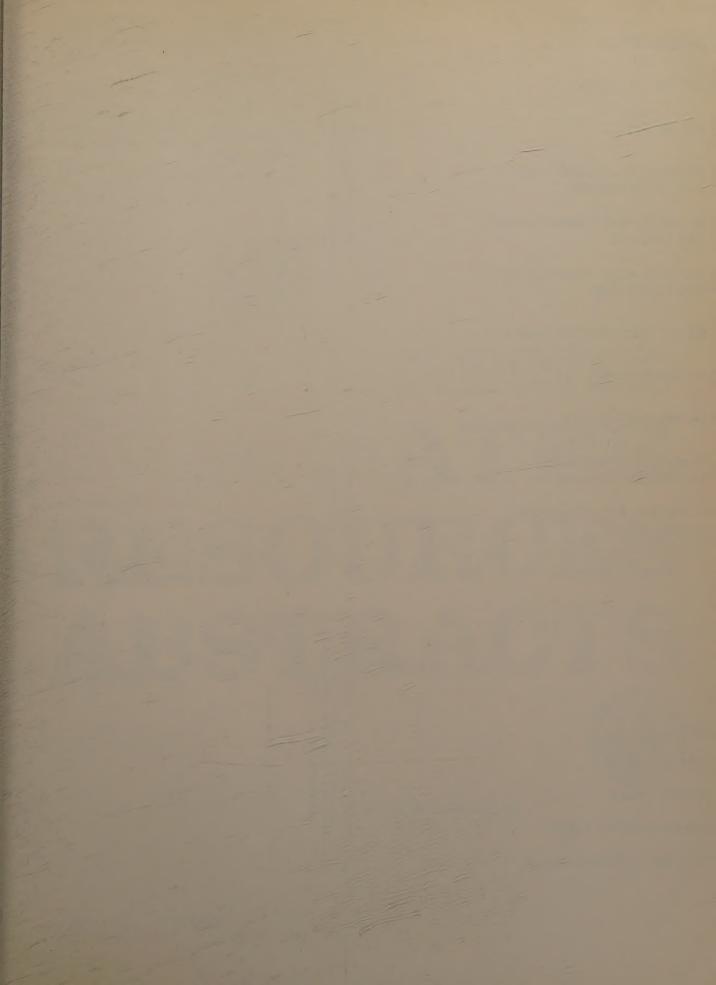
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